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CHARACTERIZATION OF TWO CORE HOLES FROM THE NAVAL OIL SHALE RESERVE NUMBER 1

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory-Cincinnati (IERL-Ci) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

In this study raw oil shale from two core holes on the Naval Oil Shale Reserve was analyzed to determine the stratigraphic distribution of major, minor, and trace elements and to determine their mineral associations. The results should be useful to government agencies and private developers involved in assessing the environmental impacts of oil shale retorting and assist in the design of appropriate control technology. For further information, contact the Oil Shale and Energy Mining Branch, Energy Pollution Control Division.

David G. Stephan
Director
Industrial Environmental Research Laboratory
Cincinnati

ABSTRACT

Raw oil shale from two core holes on the Naval Oil Shale Reserve was analyzed to determine the stratigraphic distribution of 46 major, minor and trace elements and to determine their mineral associations. Over one half of the elements correlated well with two minerals, Na-feldspar and K-feldspar. Most of these elements did not vary in concentration by more than a factor of three or four. The composition of the two core holes was very similar for corresponding stratigraphic zones even though Hole 15/16 was from the center of the Piceance Basin while Hole 25 was from the edge of the Basin. Concentrations of As, Cd, Hg, Mo, Se, B and F, which are of potential environmental interest, showed vertical variation by an order of magnitude.

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INTRODUCTION

Green River oil shale is a marlstone that contains about 20 percent organic material. It was deposited from an ancient lake that covered parts of Colorado, Utah, and Wyoming. This lake was probably permanently stratified. The upper portion supported life, and the lower layer was probably a sodium carbonate solution with a pH of 11 to 12. Oil shale was formed by lithification of sediments accumulated at the bottom of this lake. These materials entered the lake by overland runoff and atmospheric fallout of dust, pollen, and volcanic ash (Bradley, 1931).

Vertical variability in major, minor, and trace elements and mineral phases in oil shale deposits had been previously noted by Poulson et al. (1977) and by Robb et al. (1978). This variability is significant from an environmental, economic, and processing standpoint. Vertical modified in-situ (VMIS) retorts will span 300 to 700 feet or more of a vertical section of oil shale. Large changes in elemental and mineral concentrations through these sections may produce oils, gases, and waters of varying compositions. These variations may affect treatment of the waters and gases and upgrading of the oil. Significant changes in mineral forms and elemental composition across a VMIS retort will also affect the process energy balance and any catalytic effects due to specific elements. Similarly, in surface retorting, richer deposits are mined and retorted in surface retorts. If environmentally undesirable elements are concentrated in some horizons and not in others, it may be feasible to eliminate or minimize some environmental problems by preferentially mining the deposits.

This variability may also be used to identify geochemical trends and to develop correlations between certain mineral phases or Fischer Assay yields and elemental concentrations. Fischer Assays are tedious to perform and if an easily measured element could be correlated with Fischer Assay yields, it may be substituted for the assay.

Interest in mineral and element concentrations in Green River Formation oil shale has been augmented recently by geochemical and environmental considerations. Both geochemical and environmental studies require knowledge of concentrations of the major mineral and elemental components in oil shale, although interest in the minor elements varies greatly. Geochemists tend to be preoccupied with minor elements such as Sr, Ba, Ti, and U which reveal depositional trends. Environmental concerns center around potentially hazardous elements such as Hg, Cd, and Se. Each group has accumulated substantial information (see Desborough et al., 1976; Dean, 1976; Fox, et al., 1980; and Poulson et al., 1977). However, these studies do not present a realistic picture of stratigraphic element and mineral distribution through a potentially developable oil shale section.

Both environmentalists and geochemists are interested in the magnitude and significance of stratigraphic variations. To the geochemist, stratigraphic distribution is a variable answering questions about depositional conditions and the importance of this variation to formation chemistry. To the environmentalist, stratigraphic distribution provides information on the size and significance of the overall consequences of developing that oil shale deposit and controls than might be used to prevent adverse environmental impacts.

This report provides some of this basic information. It discusses the stratigraphic distribution of elements, minerals, and Fisher Assay oil and water content in two cores from the Colorado Naval Oil Shale Reserve No. 1, the site of much developmental testing and the source of most of the Green River Formation oil shale samples discussed in U.S. oil shale literature.

SUMMARY AND CONCLUSIONS

The principal phases with which the various major, minor, and trace elements are associated (based on statistical analyses) are summarized in Table 1. Specific conclusions follow.

1. Oil shale from both core holes was comprised principally of dolomite, quartz, analcime, calcite, Na-feldspar, K-feldspar, and organic matter. Mg-siderite, illite, pyrite, and aragonite were also detected in many of the samples. Illite was detected more frequently in core hole 25 (from the edge of the depositional basin) while pyrite and aragonite were detected more frequently in core hole 15/16 (center of the basin). Dawsonite and fluorite were detected in a few samples. The concentrations of dolomite and quartz were relatively constant. These two minerals typically accounted for forty weight percent of the matrix.

2. Over one-half of the elements determined correlated well with two minerals, Na-feldspar and K-feldspar (Table 1). Most of these elements did not vary in concentration by more than a factor of three or four.

3. High Fischer Assay oil yields and elevated Na- and K-feldspar concentrations were concurrent in the oil-rich Mahogany Bed for both core holes. This is consistent with other studies (Robb et al. 1978).

4. The composition of the two core holes was very similar for corresponding stratigraphic zones even though core holes 15/16 and 25 were from the center and the edge of the depositional basin, respectively, and ten kilometers apart. These studies agree with previous investigations that revealed that oil shale is remarkably uniform laterally.

5. Concentrations of major organic elements--organic carbon, hydrogen, and nitrogen--varied by an order of magnitude. Similar concentration variations were observed for As, Cd, Hg, Mo, Se, B, and F, which are trace elements of potential environmental significance. The first five of these elements may be partly associated with the organic fraction of the oil shale matrix. Boron is associated with the mineral phase. No definitive conclusions could be made for F associations based on this work. However, other work (Saether and Runnells, 1980b) suggests F is associated with micaceous clay minerals, especially illite, in the Mahogany zone.

6. The trace elements Co, Cu, Ni, Pb, Sb, and Zn showed consistent associations. These elements are probably present in oil shale as sulfides. This is consistent with findings in recent studies (Saether et al., 1980a).

7. Fischer assay water yield was strongly associated with analcime content in both cores. This parallels observations made in 1975 by Desborough and Pitman. However, the water in analcime typically accounted for only about one-third of the water content determined by Fischer Assay.

RECOMMENDATIONS

1. The mineral residence of some of the environmentally important elements, such as As, Se, Hg, Cd, Mo, B, and F, should be determined so that their behavior during and prior to retorting can be explained and predicted.

No work has been completed on As, Hg, and B, to the knowledge of the authors. The work on Cd, Mo, Se, and F started by Saether et al. (1980a) and Saether and Runnells (1980b) should be extended.

2. Elemental abundances should be determined in the Fischer Assay products--water, oil, spent shale, and gas--so that the composition of These phases can be related to the composition of the original oil shale.

3. Total sulfur and sulfur forms, including organic, pyritic, and sulfate sulfur, should be determined in many of these samples so that chacophile elements in oil shale can be identified. This information is necessary to clarify the geochemistry of the deposits and to predict the behavior of many environmentally important trace elements during retorting.

4. Soft x-ray fluorescence analyses should be performed on all samples to obtain precise and accurate measurements of the elements Si and Mg. These data would help to clarify the geochemistry of the deposits and to validate the carbonate, i.e., x-ray diffraction (XRD), results.

5. Leaching studies should be carried out on many of the composite samples. The resulting data should be correlated with the composition of the mineral phases present.

6. Methods should be developed to quantify the major mineral phases present in oil shales and these methods applied to the samples studied in this report.

GREEN RIVER OIL SHALE - A LITERATURE SURVEY

GEOLOGIC SETTING

Green River Formation oil shale is located in western Colorado, eastern Utah, and southwestern Wyoming (Figure 1). The potential oil yield of this formation has been evaluated extensively by Fischer Assay analyses on numerous cores drilled throughout the formation (Smith, Beard, and Trudell, 1979). Oil shale from the Green River Formation is a fine-grained sedimentary rock which contains appreciable quantities of organic material. The inorganic material is a dense, tough marlstone that ranges in color from tan to dark brown to brownish black. It has a typical mineral composition similar to that shown in Table 2. About one-half of the total mineral content is made up of two carbonaceous minerals, dolomite and calcite. Minor minerals which occur locally include halite (NaCl), nahcolite ($NaHCO_3$), and disseminated dawsonite ($NaAl(OH)_2CO_3$).

According to Bradley (1931), the organic fraction originated from "microscopic algae, and other microorganisms, that grew and accumulated in the central parts of large, shallow lakes that existed under a subtropical climate" and from "wind-blown, or water-borne, pollens and waxy spores." This organic fraction varies from a few percent in low-grade shales to more than 40 percent in shales that yield 75 gallons of oil per ton. The elemental composition of the organic fraction is shown in Table 2; it is reported to consist of three fractions (Bradley, 1931). Kerogen, from the Greek words for "wax yielding," typically constitutes 80 to 90 percent of the total organic matter. This material is insoluble in organic solvents and yields oil, gas, and residual carbon on pyrolysis. The empirical formula of kerogen has been reported as $C_{215}H_{330}O_{12}N_5S$ with a minimum formula weight of 3,200 (Smith, 1961). The structure of kerogen is not completely understood, even though it has been extensively studied (Robinson, 1976; Yen, 1976; Yen and Young, 1977; Down and Himus, 1941). Yen and Young (1977) postulated that kerogen is a three-dimensional network of non-straight chain clusters interconnected by long polymethylene cross-links. The clusters are primarily aliphatic rings. They suggested that organic material, possibly protokerogen or post-kerogen, is present between the clusters and that long-chain aliphatic structures are attached at one end only.

Bitumen, the second major organic fraction, typically constitutes about 10 percent of the organic material in oil shale. It is a heteroatomic polymer which is soluble in many conventional organic solvents (Sladek, 1974) and decomposes on pyrolysis. This soluble material is fractionated into about 1 percent n-alkanes, 3 percent branched alkanes, 21 percent cyclic alkanes, 2 percent aromatic oils, 63 percent resins, and 10 percent pentane-insoluble material. The third fraction, which occurs in very small amounts, is an inert substance which is insoluble in organic solvents and does not decompose on pyrolysis.

THE NAVAL OIL SHALE RESERVE

The Naval Oil Shale Reserve No. 1 (NOSR No. 1) is located in the southeast corner of Colorado's Piceance Creek Basin and is part of the Green River Formation (Figures 1 and 2). The NOSR No. 1 was established December 6, 1916, by executive order of President Woodrow Wilson as a long-range guarantee of oil for the U. S. Navy. The resource of potential oil on this reserve has been defined from oil-yield assay data on 33 cores (Smith, Beard, and Trudell, 1979). Twenty one of the cores were from within the NOSR No. 1 and twelve were from nearby areas surrounding the northwest, west, and southwestern part of the reserve.

Our geochemical studies are on two cores, 15/16 and 25, from the NOSR No. 1 as shown in Figure 2. Core hole 25 is located near the boundary of the Green River Formation close to the edge of the depositional basin. Core hole 15/16 is situated approximately seven miles (10 kilometers) to the northwest of core hole 25 and is closer to the center of the formation. Very detailed lithologic description of over 750 samples from core 15/16 has previously been prepared by Trudell (1978). His characterizations were for samples taken from 122.0 feet (37.2 meters) to 2018.9 feet (615.4 meters) deep into the core.

MINERALOGY AND ELEMENTAL COMPOSITION

Oil shale in the Green River Formation is principally dolomitic marlstone having various amounts of organic matter that was derived chiefly from algae, aquatic organisms, waxy spores, and pollen grains (Bradley, 1931). Marlstone is a term for rocks that consist mainly of mixtures of calcite and dolomite and that also contain indefinite mixtures of clay, silt, and sand particles.

The stratigraphy and mineralogy of the Green River Formation are summarized in Figure 3 and Table 3. The formation consists of oil shale interbedded with varying amounts of tuff, siltstone, sandstone, claystone, and locally with halite, trona, or nahcolite. The Green River Formation is composed primarily of lacustrine beds deposited from two large ancient (Eocene) lakes (Robinson, 1976). One of these lakes was north of the Uinta Mountains in southwestern Wyoming and northwestern Colorado. The other was south of the Uinta Mountains in eastern Utah and western Colorado. These two lakes are now preserved in seven basins (see Figure 1) -- the Uinta basin in Utah, the Piceance Creek and Sand Wash basins in Colorado, and the Green River, Great Divide, Washakie, and Fossil basins of Wyoming. The principal deposits of high-grade shale are found in the Piceance, Uinta, Green River, and Washakie basins.

An idealized cross section through the Piceance Creek Basin, which contains most of the rich oil shale, is shown in Figure 3, and the stratigraphy and mineralogy of this basin are summarized in Table 3. The rich oil shale deposits occur in the Parachute Creek member where up to 2,000 feet (610 meters) of oil shale occurs in alternating rich and lean beds. One of these rich beds, the Mahogany Zone, underlies 2,000 square miles (5180 square kilometers) in Colorado and Utah and is the principal target of most present development efforts. The oil shale is thickest and richest in the north-central part of the Piceance Creek Basin, where nodules, lenses, and beds of nahcolite, halite, and dawsonite also occur. It is leaner and thinner at the basin margins (Culbertson and Pitman, 1973).

The stratigraphy and mineralogy of the Green River Formation in the Uinta Basin is similar to that in the Piceance Creek Basin, except that the oil shale sequence is thinner and leaner and does not contain significant amounts of saline minerals. The remaining basins, the Sand Wash, the Green River, the Fossil, and the Washakie, contain oil shale that is generally leaner. This oil shale usually occurs in thinner beds. These basins are relatively unexplored, but the Green River and Washakie are of most current interest.

The elemental composition of a number of oil shale samples from different locations in the Green River Formation is summarized from the literature in

Table 4. This table presents analytical results for samples from the Mahogany Zone, the saline zone, and the R-4 Zone in Colorado and Utah. This table indicates that the major elements (concentrations >0.1 percent) in oil shales are Al, Ca, Fe, K, Mg, Na, F, Ti, S, and Si. Minor elements (concentrations of ≤0.1 percent to 1 ppm) include most of the environmentally significant elements - Mn, V, Zn, Cr, As, Cu, Mo, Ni, Pb, Co, Th, U, Sb, and Se - plus Ba, Sr, Rb, Ce, La, Nd, Ga, Y, Sc, and Cs. The trace elements (concentrations <1 ppm) include the three toxic trace elements, Cd, Hg, and Te plus Er, Eu, Lu, Ta, Tb, and Yb. This table indicates that there is thousand-fold or more variation in the elemental composition of oil shales from the same zone. This is not consistent with results reported here and may be due to analytical and/or sampling problems.

Some significant investigations of the mineralogy and elemental composition of Green River oil shale are discussed and reviewed here.

BROBST AND TUCKER (1973)

The mineralogy of the northern Piceance Creek Basin previously has been reported by Brobst and Tucker (1973). The mineral composition was found to consist of various mixtures of dolomite, calcite, quartz, K-feldspar, Na-feldspar, analcime, illite, and pyrite. Dolomite was the most abundant mineral. Calcite was found to occur in more samples and in greater abundance above the Mahogany Ledge of the formation. Quartz content was reported to have varied within narrow limits. Potassium feldspar was found to be present in more samples and in slightly greater abundance than Na-feldspar as measured by x-ray diffraction peak height. Analcime was found to occur in most samples, but in slightly more abundance in the rich oil shale than in marlstone. Also, small amounts of illite were common. Pyrite was determined to be an accessory mineral that was more abundant in rich oil shale than in marlstone.

POULSON ET AL. (1977)

These investigators presented survey analyses for over 60 elements in two Green River Formation oil shale zones as a function of depth in the formation. The zones sampled were the Mahogany Zone in Colorado and Utah and the saline zone below the Mahogany Zone in Colorado (see Table 3). Cores from these zones were sectioned, composited at 10-foot (3.1 meter) intervals, reduced to minus 100 mesh, blended, and analyzed primarily by spark source mass spectrometry. Limited use was made of x-ray fluorescence spectrometry and neutron activation analysis. These authors noted significant variability between duplicates analyzed by the same technique and concluded that the data were good only to a factor of ten (variability, as used here, refers to the ratio of the maximum value to the minimum value). Because of this large variability, they concluded that there was no significant difference in the elemental composition of the stratigraphic zones.

DESBOROUGH ET AL. (1976)

These investigators reported elemental abundances for 36 elements for ten samples from drill core of two rich oil shale beds from the Parachute Creek member of the Green River Formation. Six of the samples were from the Mahogany Bed in Colorado and Utah and four were from the R-4 Zone (see Table 3). A range of analytical techniques, including x-ray fluorescence spectrometry, atomic absorption spectroscopy, and optical emission spectroscopy were used.

The variability noted in this study was considerably less than that observed by Poulson et al. (1977). The Desborough study found a factor of two to three variability while the Poulson study (1977) found a factor of ten or more. This is probably related to the fact that higher precision analytical techniques were employed and to the fact that a smaller set of samples was analyzed. Analysis of the data in Table 4 suggests that there is little variation between the Mahogany Bed and the R-4 Zone samples.

These investigators also inferred or established the mineralogical residence for 22 elements using x-ray diffraction and the electron microprobe. Some of their results are as follows:

- Sulfides: As, Cd, Co, Cu, Fe, Mo, Ni, S, Zn
- Carbonates: Ca, Fe, Li, Mg, Mn
- Feldspars: Al, B, K, Si
- Siderite: Fe, Mg, Mn

Additionally, F was hypothesized to occur in fluorite and cryolite; P in apatite; Zr in zircon; Na in dawsonite, albite, analcime, and nahcolite; and Se in iron selenide. However, subsequent work by Saether et al. (1980a) and Saether and Runnells (1980b) suggest that Mo occurs in the clay and mica minerals, that Mn and Cd have a dual residence in the pyrites and carbonates, and that F is associated with micaceous clays, especially illite.

FRUCHTER ET AL. (1978, 1979)

These investigators analyzed mine-run samples from the Anvil Points, Colorado, oil shale mine using neutron activation analysis, x-ray fluorescence spectrometry, and other techniques. Their data agree with the Desborough study and the variation in their data is typically less than a factor of two. This is probably related to the fact that all of their samples originated in the same mine, and analytical techniques of known high precision were used.

DONNELL AND SHAW (1977)

These researchers reported mercury analyses and oil yields for 183 samples from a core hole southeast of lease tract C-b in the Mahogany Zone. A 258.5-foot (78.8-meter) interval between the depths of 770.5 feet (234.8 meters) and 1029 feet (314 meters) was composited at 1- to 18-foot (0.3- to 5.5-meters) intervals, crushed, dissolved in an acid solution, and analyzed by atomic absorption spectroscopy. The mercury content was found to average 0.37 ppm and to range from less than 0.10 ppm to 0.97 ppm. No correlation between oil yield and mercury content was evident, suggesting that mercury may not reside in the organic fraction. Variability between samples was outside of the reported precision of the analytical method (±0.010 ppm) suggesting that mercury varies throughout the Mahogany Zone.

SAETHER ET AL. (1980a, 1980b)

These investigators used differential density centrifugation and several analytical techniques to investigate the mineral residence of 26 elements in Colorado oil shales (Saether et al., 1980a). They studied 11 samples of raw shale from the Mahogany Zone from the U.S. Bureau of Mines drillcore 01-A from the central part of the Piceance Creek Basin in northwestern Colorado. They removed organic material from their samples using low-temperature plasma ashing, separated their samples into 2.4 to ≥ 2.9 g/cm^3 density fractions by differential centrifugation, and analyzed the various fractions for mineral phases and 26 elements using x-ray diffraction, x-ray fluorescence analysis, and nuclear inelastic scattering.

This study revealed that trace heavy metals (Zn, As, Ni, Pb, Cu, Se) in rich oil shale are primarily concentrated in minerals that have densities greater than about 2.9 g/cm^3. The principal minerals found in this fraction are pyrite and iron-rich carbonates. These investigators hypothesized that the probable mineralogical residence of the transition metals is in the sulfides, chiefly pyrite. This agrees with the work of Desborough et al. (1976). No significant enrichment of any of the trace elements studied was found in the lighter density fractions except Mo which was hypothesized to occur in the clay and mica minerals. Mn and Cd were believed to have a dual residence, occurring in both pyrite and carbonate phases. The F was chiefly concentrated in the light micaceous fraction. Other work on the same set of samples (Saether and Runnells, 1980b), suggested that a major portion of the F in the Mahogany Zone is associated with micaceous clay minerals, especially illite. Other fluorine-bearing minerals, such as fluorite (CaF_2), cryolite (Na_3AlF_6), and fluorapatite [$Ca_5(PO_4)F$] were not detected. It was hypothesized that F substitutes for hydroxyl ions in the illite lattice or is adsorbed on the surface by ion exchange. These authors also found a good correlation between F and Fischer Assay oil yield.

OTHER STUDIES

Wildeman and Meglen (1978) analyzed a single sample from the Mahogany Zone at the Colony mine, Colorado, for 14 elements using x-ray fluorescence spectrometry and wet chemical techniques. Similarly, Shendrikar and Faudel (1978) analyzed three samples of oil shale from the Mahogany Zone at the Colony mine, Colorado, for 15 trace elements using atomic absorption spectroscopy and other techniques. The results obtained on these samples from the same location agree with the exception of selenium.

Stanfield et al. (1951) determined the form of sulfur and nitrogen in nine samples of oil shale from the Mahogany Zone near Rifle, Colorado. Raw oil shale was found to contain three principal types of sulfur--pyrite, organic, and sulfate sulfur. Pyrite sulfur, which constituted 66 percent of the total sulfur, occurred as minute grains distributed throughout the entire shale mass or as occasional nodules. About 33 percent of the total sulfur occurred as organic sulfur and less than 1 percent occurred as sulfate sulfur. The nitrogen appeared to occur entirely as organic nitrogen.

EXPERIMENTAL

Two cores from the Green River Formation on Colorado's Naval Oil Shale Reserve No. 1 were sectioned and composited into 280 samples at 1-, 2-, 5-, 25-, or 50-foot (0.3-, 0.6-, 1.5-, 7.5-, or 15-meter) intervals based on stratigraphy. Measurements for 57 elements were carried out on the individual samples using analytical methods summarized in Table 5. Most of these techniques had been previously validated for use with oil shale samples (Fox et al., 1980). The relative abundance of the 12 minerals listed in Table 6 were ascertained by x-ray diffraction (XRD) at Laramie Energy Technology Center (LETC). Fischer Assays, a standard procedure for the determination of oil yield, were also performed at LETC.

The resulting data were entered into a computerized data base system and statistically analyzed to identify trends and relationships. Quality control was provided by computing and comparing relative minimum-maximum values of each variable for the different stratigraphic zones.

Core stratification and sectioning, sampling and sample preparation, sample analysis, and data reduction methods are discussed in greater detail below.

CORE STRATIFICATION AND SECTIONING

Two cores from the Department of Energy's Naval Oil Shale Reserve No. 1 in the Piceance Creek Basin were used in this study. Core hole 15/16 was drilled in the SWNENW of section 34, T5SR95W, and core hole 25 was drilled in SWSENE of section 34, T5SR94W. Both are located in Garfield County, Colorado. Smith et al. (1979) relate the oil shale resource information contributed by these two cores to the Naval Oil Shale Reserve No. 1. Core hole 15/16 is in the northwest corner of the Reserve, significantly nearer the Mahogany Zone's depositional center (Smith, 1974) than core hole 25, which is near the basin edge (Figure 2). Material analyzed from core hole 15/16 represented 1163 feet (354 meters) of Green River Formation; material from core hole 25 represented 660 feet (201 meters).

Core holes 15/16 and 25 were stratigraphically sectioned and composited into 280 samples by the Laramie Energy Technology Center (LETC) at intervals of 1, 2, 5, 25, or 50 feet (0.3, 0.6, 1.5, 7.5, or 15 meters), as shown in Table 7. A current oil shale technology potentially applicable to each section is noted in Table 7.

Sectioning of the cores was accomplished with a diamond saw. Each section was crushed and ground to 1/8-inch (3.2 millimeter) particle size using a high-grade steel jaw crusher and a coffee-mill grinder. This portion of the sample preparation step was not checked for contamination due to the lack of a suitable control when the study was made.

SAMPLING AND SAMPLE PREPARATION

The laboratory procedures described in this section were adopted to select, as nearly as possible, a representative sample from each composite, to reduce the particle size to a range compatible with various analytical methods, and to maximize homogeneity and minimize contamination. Homogeneity and contamination experiments were conducted to validate these procedures.

The 280 samples came in several sizes, weighing up to 44 pounds (20 kilograms) each. Thus, development of a representative sampling technique was required. Of the 280 composite samples received, 19 fifty-foot

(15.2-meter) composites weighed approximately 44 pounds (20 kilograms) each, 136 five-foot (1.5-meter) composites weighed 5.1 to 11 pounds (2.3 to 5.0 kilograms), 79 two-foot (0.6-meter) composites weighed 2.2 to 6.6 pounds (1.0 to 3.0 kilograms) and 46 one-foot (0.3-meter) composites weighed 0.2 to 1.0 kilogram.

Each sample was mixed and split into 0.44 pounds (200-gram) sizes and pulverized to 100 to 200 mesh (150 to 75 microns). A manual splitting procedure was used to minimize contamination from metal mechanical splitters. Each composite was placed on a 10 mil (0.025 cm) thick sheet of polyethylene film in a positive ventilation hood and mixed and split according to the scheme shown in Figure 4 into 1.8-pound (800-gram) splits. Two 1.8 pound (800-gram) splits were selected and the balance of the composite returned to its original container. One of the two samples was stored as a record. The other was further divided by the same method into a 0.44 pound (200-gram) sample for pulverizing.

The 0.44 pound (200-gram) samples were ground in a laboratory planetary ball mill equipped with four high-purity sintered corundum (Al_2O_3) jars and balls. Three 1.6 inch (40 millimeter) diameter grinding balls were used in each jar. Four jars were simultaneously loaded with 0.44 pound (200-gram) portions of four separate samples and ground for one hour. The grinding regime produced particles smaller than 100 mesh (150 microns). The charge from each jar was transferred to polyethylene bottles which had been acid-washed with HNO_3, rinsed with de-ionized water, and air dried under a plastic hood.

Two experiments were conducted to evaluate the effect of sampling methods on homogeneity of the composited oil shale and the possible contamination of the samples by the sintered corundum grinding jars and balls.

HOMOGENEITY EXPERIMENT

The purpose of this experiment was to determine how reproducibly 1.8 pound (800-gram) samples could be quartered and subsampled. A 1.8 pound (800-gram) sample of shale from the 180-foot (54.9-meter) depth, solution cavity zone, (SCZ-180) was quartered into four 0.44-pound (200-gram) portions. Each portion was pulverized using procedures previously described. A total of ten 1.54-grain (100-milligram) samples were taken of the pulverized material, four samples from one jar and two from each of the other jars. All ten were analyzed by neutron activation analysis. The results of these measurements (Table 8) indicate that a 1.8 pound (800-gram) sample can be reliably split into four 0.44-pound (200-gram) samples and that representative 1.54 grain (100-milligram) samples can be withdrawn from the pulverized 0.44 pound (200-gram) material. These sampling procedures lead to abundances which are probably representative of the cores within a standard deviation of about 1.4 percent.

CONTAMINATION EXPERIMENT

The sintered corundum grinding jars of the planetary ball mill were tested in this experiment for possible contamination of the oil shale. Napa obsidian, well analyzed for nearly 50 elements by high precision neutron activation analysis (Bowman et al., 1973), provided the control for the experiment. This material was chosen because it is harder than oil shale, and thus more susceptible to contamination during grinding, and because its chemical composition is remarkably uniform. As a precaution, the jars were washed in de-ionized water and soapless cleanser.

Two hundred grams of Napa obsidian were ground for an hour in one factory-clean sintered corundum grinding jar and in one jar which had been used previously to grind oil shale; a smaller portion of obsidian was ground by hand in an agate mortar and pestle. One sample each was prepared from the obsidian ground in these three operations and analyzed by neutron activation analysis.

The results shown in Table 9 indicate that the obsidian was pulverized without significant contamination from the sintered corundum grinding jars and balls. Even though the difference between the Al value for the sample ground in the used jar and that ground in the new jar is greater than the standard deviation of the difference, there is only a 1 in 20 probability that this is statistically significant.

NEUTRON ACTIVATION ANALYSIS

All 280 samples were analyzed by instrumental neutron activation analysis (NAA) at the Lawrence Berkeley Laboratory. The elements Ag, Al, As, Au, Ba, Br, Ca, Cd, Ce, Cl, Co, Cr, Cs, Cu, Dy, Eu, Fe, Ga, Hf, In, Ir, K, La, Lu, Mg, Mn, Mo, Na, Nd, Ni, Rb, Sb, Sc, Se, Sm, Sn, Sr, Ta, Tb, Th, Ti, U, V, W, Yb, and Zn were determined. A single sample was analyzed, and the reported error is an estimate of one standard deviation in the accuracy calculated from the counting statistics of both the samples and the standards and the uncertainties in the elemental abundances in the standards.

These procedures have been described elsewhere (Perlman and Asaro, 1969). Standard pottery (Perlman and Asaro, 1969), KCl, $CaCO_3$, and Al foil served as calibration standards. Approximately 1.54 grains (100 milligrams) of sample are mixed with 0.77 grains (50 milligrams) of cellulose and compacted into a 0.4-in. x 47-mil (1-cm x 1.2-mm) pill using a hand-operated hydraulic press. The sample is wrapped in thin polyethylene and placed in radial array with four other samples and five standards in a heavy-duty polyethylene irradiation capsule. The sealed capsule is suspended by a wire in the central thimble of the Berkeley Triga Reactor and rotated during irradiation. The procedure used to analyze the resulting pills consisted of two irradiations and five decay/counting measurements (Table 10). Three of these are made with a 0.4-cubic inch (7-cc) intrinsic Ge detector with a resolution of 1.6 keV at 1 MeV, and two are made with a 0.06-cubic inch (1-cc) Ge(Li) detector with a resolution of 0.54 keV at 103 keV. For the second irradiation, the samples were rewrapped in high-purity Al foil and placed in radial array in an Al irradiation capsule.

X-RAY FLUORESCENCE ANALYSIS

The elements Br, Cu, Ga, Ge, Ni, Pb, Rb, Se, Sr, Y, Zn, and Zr were determined by X-ray fluorescence at LBL for all 280 samples. The instrumental method is described elsewhere (Giauque et al., 1977). A single sample was analyzed, and the reported errors are the larger of the two standard deviations from the counting statistics or 4 percent of the reported value. The system used consists of a prototype energy-dispersive x-ray fluorescence spectrometer designed and built at LBL. The total system resolution FWHM was 190 eV at 6.4 keV (Fe Kα x-ray) at 5000 counts per second using an 18-microsecond pulse peaking time. Excitation is provided by a Mo x-ray tube with external Mo filters. The x-ray tube is operated at 45 kV and regulated currents varying from 100 to 245 μA. The resulting x-rays are simultaneously measured by a guard-ring detector with pulsed-light feedback electronics and a 512-channel pulse height analyzer.

The sample preparation methods used are described by Giauque et al. (1977). Approximately 31 grains (2 grams) of powder are pressed into a Lucite cylinder and analyzed using the system described above. The samples are counted for 20 minutes.

ZEEMAN ATOMIC ABSORPTION SPECTROSCOPY

This technique was used to measure Hg in all 280 samples and Cd in all samples from core hole 25. Three or more replicates of each sample were analyzed. The instrumental technique has been described elsewhere (Hadeishi and McLaughlin, 1975). An electrodeless discharge lamp was used for mercury, and a magnetically confined lamp (MCL) was used for cadmium (Hadeishi and McLaughlin, 1978). Mercury was atomized in a T-shaped combustion tube maintained at 1652°F (900°C) and cadmium was atomized in a new furnace, the Extended Range High Gas Temperature Furnace. The samples were directly analyzed with no dilution or chemical pretreatment. Concentrations were determined from standard curves using peak heights (mercury) or peak areas (cadmium). A standard curve consisting of at least four points was run at the beginning and end of each session at the instrument and select standards were sandwiched between samples throughout a run to monitor instrument stability. Aqueous standards were prepared daily in a 1 percent HNO_3 matrix from 1000 ppm stock solution. Instrument operating parameters were experimentally determined for each element and sample type by varying argon and air flow rates, MCL vacuum, drying-charring-atomization time and temperature, and furnace type. These were set to maximize signal-to-noise ratio, to minimize self reversal of the plasma in the light source, to minimize analyte loss during drying and charring, to separate smoke and analyte signals, and to prevent molecular formation. Reference standards, including National Bureau of Standards (NBS) standard reference materials (coal, coal fly ash, and orchard leaves), USGS rocks, and reference standards prepared as part of this work were periodically run throughout each session to check standards and instrument operation.

SPECTROCHEMICAL DETERMINATION OF BORON

A single replicate of each sample was analyzed for boron at Los Alamos Scientific Laboratory (LASL) using a dc-arc excitation spectrographic method. A 0.15-grain (10-milligram) electrode charge (1 part sample and 3 parts graphite - 4 percent NaCl buffer) was burned for 15 seconds in a 15-Å dc arc (short-circuit measurement). A Zeebac, Inc., Atmojet provided an atmosphere of 70 percent argon - 30 percent oxygen around the arc. Spectra were recorded on Eastman Kodak Spectrum Analysis No. 3 film using a 4.9-foot (1.5-meter) ARL spectrograph with a reciprocal linear dispersion of 0.7 micrometers per millimeter. References were prepared in a mixture of Si, Al, Ca, Fe, K, Mg, Na, and Ti oxides or carbonates to which B was added at concentrations of 1000, 300, 100, 30, 10, 3, and 1 ppm (microgram of element per gram of matrix). Duplicate exposures of all of the references were made on a master film, and single exposures of the 30 ppm and 100 ppm references were made as controls on each sample film along with duplicate exposures of each sample. Results were obtained by comparison of the analytical lines on the master film with the same lines on the several films for the samples after making corrections relative to the two controls on each film. The B 249.6 μm line was used. The detection limit for B was 10 ppm.

PYROHYDROLYSIS-SPECTROPHOTOMETRIC DETERMINATION OF FLUORIDE

Fluoride was measured at LASL by a pyrohydrolysis-spectrophotometric method. Duplicate 1.54 grain (100-milligram) samples of pulverized oil shale were mixed with depleted uranium oxide to catalyze removal of fluoride and pyrohydrolyzed in steam at 1832°F (1000°C). The distillates containing the fluoride were collected in volumetric flasks containing boric acid solution, and a chelate of Ce and alizarin complexone was added to each to develop a characteristic color. The intensity of the colored complex, measured spectrophotometrically at 620 nanometers, was directly proportional to the concentration of fluoride in the sample. Reference samples containing known quantities of fluoride were analyzed concurrently with the oil shale samples to calibrate the method. The detection limit for F was 10 ppm.

INSTRUMENTAL ANALYSIS OF C, H, AND N

Total hydrogen and total nitrogen were determined at LETC by an F and M model 185 CHN Analyzer. Total inorganic and organic carbon were determined on a Coulometrics Carbon Analyzer. A single replicate of all 280 samples was analyzed.

X-RAY DIFFRACTION

All 280 samples were analyzed by x-ray diffraction at LETC to identify and, in some cases, quantitate the minerals dolomite, calcite, aragonite, Mg-siderite, dawsonite, K-feldspar, Na-feldspar, analcime, illite, quartz, pyrite, and fluorite.

Samples for X-ray diffraction analysis were pulverized by a standard procedure and packed identically to insure comparable diffraction results (Robb and Smith, 1974; Smith and Robb, 1973). X-ray diffraction patterns were obtained with a diffractometer using CuKα Ni filtered radiation. The patterns were recorded under standardized conditions on 10-inch (25.4 centimeters) 100-unit chart paper at a goniometer scanning speed of $2^{o}2\theta$ per minute and a chart speed of one inch (2.54 centimeters) per minute. The data control unit was set at 100 counts full scale, multiplier at 1, and time constant of 5. Peaks off the chart were rerun with a higher multiplier, then converted to their equivalent in 100 counts full scale. Individual peak heights were measured above background in chart units for the primary peak of each of the 12 minerals being investigated. Measured mineral peak heights are reported for illite, fluorite, pyrite, Na-feldspar, K-feldspar, Mg-siderite, dawsonite, and aragonite. Although these values are not quantitative without calibration, they do give a reliable relative measure of the amount of a mineral from sample to sample. Semiquantitative estimates of weight percent of analcime, calcite, quartz, and dolomite were made from peak heights using techniques previously described (Robb, Smith, and Trudell, 1978).

FISCHER ASSAY

Standard Fischer Assays were performed at LETC on all 280 samples and the weight percent oil, water, spent shale, and gas plus loss, and water and oil yields in gallons per ton were calculated. The proposed ASTM standard method (Smith, 1979) was used in these analyses. In this method, a 1500-grain (95-gram) sample of 8-mesh (2.4-millimeter) oil shale is heated from ambient temperature to 932°F (500°C) in a cast aluminum alloy retort. The vapors distilled from the sample are cooled and the condensed fraction is collected. The oil and water fractions are separated, the water volume, converted to weight equivalent, is measured and subtracted from the oil plus water weight. The weight of uncondensable gases (gas plus loss) is then calculated by difference. This fraction arises from organic material and minerals which may release hydrogen sulfide and carbon dioxide on heating (Smith, 1979).

DATA ANALYSIS

The results determined for 57 elements, eight minerals, and oil and water yield were entered into a computerized data base system. An LBL computer statistical program package was used to determine the Pearson correlation coefficients and corresponding statistical significance values for select pairs (Nie et al., 1975). These values were used to identify relationships between minerals, elements and Fischer Assay products. Samples were treated as individual groups based on each core hole and the individual stratigraphic zones.

STATISTICAL PROCEDURES

The statistical procedure used to determine the strength of the relationship for pairs of variables was least-squares linear regression. The method is based on the belief that the best fitting straight line is the one in which the vertical distances of all the points from the line is minimized. The general formula for a straight line is

$$Y = aX + b$$

where b is the intercept and a is the slope of the line.

The Pearson product-moment correlation coefficient, symbolized by r, serves as a measure of the fit of the straight line to the points used in the regression calculations. When there is a perfect fit (no error), r takes on a value of +1.0 or -1.0, where the sign is the same as the regression coefficient a. A negative r does not mean a bad fit, rather it denotes an inverse relationship.

Mathematically, r is defined as the ratio of covariation to the square root of the product of the variation in X and the variation in Y, where X and Y symbolize the two variables. The value of r is expressed as:

$$r = \frac{\Sigma_{i=1}^{N} (X_i - \bar{X})(Y_i - \bar{Y})}{\left\{\left[\Sigma_{i=1}^{N} (X_i - \bar{X})^2\right] \left[\Sigma_{i=1}^{N} (Y_i - \bar{Y})^2\right]\right\}^{1/2}}$$

where X_i = i^{th} observation of variable X.

Y_i = i^{th} observation of variable Y

N = number of observations

$\bar{X}$ = $\Sigma^N_{i=i} X_i/N$ = mean of variable X

$\bar{Y}$ = $\Sigma^N_{i=1} Y_i/N$ = mean of variable Y

This formula can be restated by dividing the numerator and denominator by N - 1 to show that the correlation coefficient can also be defined as the covariance in X and Y divided by the product of their standard deviations. The covariance in X and Y is defined as:

$$\frac{\Sigma^N_{i=1}(X_i - \bar{X})(Y_i - \bar{Y})}{N - 1}$$

The actual formula used by the Statistical Package for the Social Sciences (SPSS) (Nie et al., 1975) for computing Pearson correlation coefficients is:

$$r = \frac{\Sigma^N_{i=1} X_i Y_i - \left(\Sigma^N_{i=1} X_i\right)\left(\Sigma^N_{i=1} Y_i\right)/(N)}{\left\{\left[\Sigma^N_{i=1} X_i^2 - \left(\Sigma^N_{i=1} X_i\right)^2/N\right]\left[\Sigma^N_{i=1} Y_i^2 - \left(\Sigma^N_{i=1} Y_i\right)^2/N\right]\right\}^{1/2}}$$

Statistical significance values were calculated for each of the Pearson correlation coefficients. These significance values are derived from the use of Student's t with N-2 degrees of freedom for the computed quantity:

$$r\left[\frac{N-2}{1-r^2}\right]^{1/2}$$

Applying the criteria used by Robb et al. (1978), correlations showing greater than a 95 percent probability of not being zero were deemed significant.

The above procedures permitted establishing the significance of the Pearson correlation coefficients for any pair of variables for each stratigraphic zone, independent of the number of samples from a zone.

Only variables for which quantitative values could be determined in all or a large fraction of the composited samples were included in the correlation program. Results for samples composited at greater than 5-feet (1.5-meter) intervals were not included. This eliminated 19 of 280 samples. Additionally, eight elements (Ag, Au, Br, Cl, Ge, In, Ir, and Sn) and four minerals (aragonite, dawsonite, illite, and fluorite) were eliminated from the statistical analysis. In the few cases for which any of the remaining variables could not be quantified for an individual sample (i.e., such as for an upper limit), the variable value was set at zero and excluded from the correlation computations. These criteria left 48 elements, eight minerals, and oil and water content for statistical analysis. Mineral x-ray diffraction peak height data were used for all mineral phases, including those with estimated weight percents. These give a more reliable relative measure of the amount of a mineral from sample to sample than the semi-quantitative weight percents. Robb et al. (1978) corrected X-ray diffraction results for organic volume content to compensate for the diluting effect of the organics on the mineral content. These corrections were calculated using the following equation:

$$\text{Organic content, volume percent} = \frac{164.85 + X}{X + 111.46}$$

where X = oil yield determined by Fischer Assay in gallons per ton. However, for the reason listed below, the above correction was not applied to the XRD results for cores 15/16 and 25 prior to the calculation of the statistical significance values.

Calcium, magnesium, and mineral carbon content were calculated from the estimated weight percent dolomite plus calcite, the major minerals which contain these constituents. A comparison was made of the calcium, magnesium, and carbonate values determined experimentally with the same three values calculated from the XRD dolomite plus calcite estimated weight percent corrected for organic volume content. It was determined that the organic volume content corrections applied were far too large for samples which yielded Fischer Assays above 25 gallons per ton. At 35 gallons per ton or more, the corrected results were typically high by a factor of two or more. For these samples, uncorrected results were in much better agreement with experimental determinations. Consequently, no corrections of X-ray diffraction results were made prior to statistical analyses.

Robb et al. (1978) also made corrections for nahcolite content, a major mineral in saline zone samples. Since nahcolite was not found to be present in any of the core 15/16 or 25 samples, this correction was not made here.

Thus, in summary, for this paper, none of the results are adjusted for organic value content prior to the determination of the correlation coefficients and statistical significance values for different pairs of variables. The number of samples from the different stratigraphic zones of each core vary considerably. Consequently, statistical significance values (SSVs) are used for comparison purposes, since the SSVs are independent of the number of samples from each stratigraphic zone.

RESULTS

The detailed measurements made on the 280 samples from core holes 15/16 and 25 are presented in tables in the appendix. The computerized data system was used to plot histograms.

For statistical purposes, the results determined for each core hole were broken down into individual groups. The groups corresponded to the different stratigraphic zones for which samples were composited at 5-foot (1.5-meter) intervals or less. The overlying oil shale, the upper Mahogany Zone, the Mahogany Bed, the lower Mahogany Zone, and the rich oil shale were the five stratigraphic zones of core hole 15/16 for which the above criterion was met. The corresponding stratigraphic zones of core hole 25 were composited at intervals similar to those of core hole 15/16, except there was not a rich oil shale zone.

Relative minimum-maximum values were calculated for each variable on a group basis for each core hole. Pearson correlation coefficients and corresponding statistical significance values were determined for pairs of variables for each of the above groups. The results are summarized here.

Figures 5 and 6 illustrate the stratigraphic zones, the depth of the zones, and the composite sampling intervals for the two core holes. The average and range of the Fischer Assay oil yields (gallons per ton) are listed for each zone. The pattern coding used on these figures will be used in subsequent displays to identify various stratigraphic zones.

Table 11 lists the range of Fischer Assay and mineral results for both core holes, and Table 12 summarizes concentration ranges for all the elements. In nearly all cases, the range of values for each variable is very similar for the two core holes. This illustrates, in a broad manner, the degree of horizontal uniformity across the Green River oil shale deposit.

Figures 7 to 12 summarize relative minimum-maximum values determined for each variable by stratigraphic zone. The graphic textures are consistent with those in Figures 5 and 6. The minimum and maximum value for each stratigraphic zone were divided by the maximum value for that variable in all the stratigraphic zones composited at intervals of 5 feet (1.5 meters) or less. The resulting values are plotted in Figures 7 to 12. The first bar for each zone represents the ratio of the minimum value in the overlying oil shale zone to the maximum value for that variable and the second bar is the ratio of the maximum value of this same zone to the maximum value for the variable. Values for the other stratigraphic zones are illustrated in core hole sampling sequence. These ratios normalize the variability by zone to the maximum observed value for the core through the stratigraphic zones of interest.

Figures 13 to 26 are histograms of results for individual composite samples from the two core holes. These graphic textures are also consistent with Figures 5 and 6 to illustrate the various stratigraphic zones. Results are not presented for four depth intervals (1196 to 1199, 1289 to 1290, 1295 to 1298, and 1426 to 1440 feet) for core hole 15/16 as no samples were available.

Pearson correlation coefficients and corresponding statistical significance values (SSVs) were calculated for each variable pair on a group basis.

Correlations showing greater than a 95 percent probability of not being zero were deemed significant. This is consistent with criteria used by Robb et al. (1978). Tests for significance were previously established (Arkin and Colton, 1950; Smith and Robb, 1973). Approximately 15,000 data sets were evaluated in our program.

Table 13 lists statistical significance values (SSVs) determined for 48 individual elements paired with 29 of the same elements. Listed SSVs are for variable pairs which had positive Pearson correlation coefficients. Groups 1 through 5 correspond to the five stratigraphic zones: overlying oil shale through rich oil shale, respectively.

Table 14 lists SSVs calculated for 48 individual elements paired with eight minerals and Fischer Assay products oil and water. Table 15 lists SSVs determined for the eight minerals, oil, and water when coupled together. Variable pairs which had negative Pearson correlation coefficients (inverse relationships) are shown in parentheses in Table 15.

Figures 27 to 39 summarize sets of statistical significance values (SSVs) determined for 11 elements (Al, As, B, Ca, Co, F, Hg, Mg, Mo, Sb, and U). Again, textures consistent with Figures 5 and 6 are used for the different stratigraphic zones. In each case, the values for the five stratigraphic zone of core hole 15/16 are illustrated before the four similar corresponding stratigraphic zones of core hole 25.

DISCUSSION

The determination of significant relationships between minerals, elements, and oil and water yield is complicated by the fact that oil shale was formed by a very slow sedimentation process which annually produced thin geologic laminations or varves (Bradley, 1931). Thus, an oil shale composite section one foot (0.30 meter) in thickness can represent hundreds to thousands of years of deposition (Robb et al., 1978). Such a section would contain a great many geologic laminations, each representing a specific set of deposition conditions. These conditions probably changed during the very long time intervals represented by a composite sample. Only geochemical relationships persisting over very long periods of geologic time will produce detectable effects. This section will identify and discuss relationships between the various mineral, element, and Fischer Assay products.

ELEMENTAL ABUNDANCE

The most notable result of this study was the demonstration of a remarkable stratigraphic uniformity in mineral and element composition of oil shale from both cores. This uniformity is apparent in the histograms (Figures 13-26) and in the average elemental concentrations summarized by stratigraphic zone in Tables 16 and 17. The resulting averages and their associated standard deviations demonstrate the uniformity under discussion. The standard deviations in Tables 16 and 17 permit probability estimates for replication of the means. If the standard deviation is divided by $\sqrt{N}$ and multiplied by an appropriate value for t based on the number of samples and the probability desired, an estimate is obtained of the limits within which a new mean would occur if the experiments were repeated. For example, in Table 16, the average Mahogany Bed value for Zr is 26.2 ppm with a standard deviation of 8.5. With t at the 99 percent level for 26 samples (2.79), the population mean (average Zr in Mahogany Bed samples) is 99 percent probable to lie within 26.2 ± 4.6 ppm Zr.

Another estimate illustrating stratigraphic deposit uniformity is furnished by estimating the percentage of sample results which will be within specific limits around the mean. These values are obtained as t times the standard deviation where t is again a probability function. If t again is taken at 2.79 for the 26 analytical results yielding the average for Zr, 99 percent of the results will lie within 24 ppm of the 26.2 mean. In spite of all the variables associated with long slow carbonate deposition, the range of Zr analytical values is less than two times the mean value. Most of the element averages in Tables 16 and 17 meet this test.

A few do not. Fluorine and boron do not because of their analytical uncertainties. As, Hg, K, Sb, and Se are other elements with 99 percent error limits larger than two times their means. They appear to fall into two groups. As, Hg, and Se appear to have been collected by organic matter, an association to be discussed later. K and Sb are part of a group associated with incursion of air-borne clastic influx.

Variations in elemental abundances may be caused by nonuniform influxes of organic matter, calcite precipitates, or volcanic ash falls into the ancient lake from which oil shale was deposited. Much of the variation across the stratigraphic zone averages in Tables 16 and 17 appears associated with dilution by organic matter. Effects of the other diluting factors are more limited in thickness.

Calcite pulses, caused by carbonate precipitation from the surface of the lake, cause diluting effects in the elemental abundances. In Figure 13 a strong calcite pulse appears at depths slightly greater than 950 feet (290 meters). This calcite elevation is mirrored as a dent in the plots for K-feldspar, Na-feldspar, quartz, and dolomite in Figure 13; all of the entries in Figure 14; Ti, Fe, and Al in Figure 15; all elements in Figure 16; U in Figure 18; and N in Figure 19. A calcite pulse in the Core 25 histogram (Figure 20) appears at a depth of about 385 feet (117 meters), the identical stratigraphic position. It also created corresponding dents in the same set of plots.

This calcite pulse created a diluting effect as evidenced by the histogram dents. The mechanism that created it covered both core hole locations. Consequently, a widespread event depositing only calcite is indicated. Precipitation of calcite from the lake's surface water is indicated.

In spite of the dilution effects created by ash falls, their most probable product, analcime, is rather uniform. Only where ash falls were completely converted to feldspars are there major discontinuities in analcime amounts. Calcite is the other mineral not formed under the geochemical control of the lake as postulated by Smith (1974). The resulting mineral products, particularly quartz and dolomite, are rather uniform.

Many of the elements occur in the oil shale at levels at or below crustal abundance. Using Mason's 1960 crustal abundance table, only the carbonate elements Ca, Mg, Ba, and Sr plus U, Mo, As, Se, and perhaps Pb and W appear enriched. The enrichment mechanisms for the carbonate minerals depends on their ease of precipitation. Barium may be present as barite as well, but about half the Ba is soluble in dilute HCl. The elements U and Mo appear to be associated with organic matter as will be discussed later. The As, Se, and perhaps Pb and W were probably initially collected by the organic matter and then released to form sulfides. Two more of the elements in Tables 16 and 17 appear enriched, F and B. Enrichment of these in a saline lake is to be expected, but the certainty of their analytical results is limited.

MINERAL AND ORGANIC RELATIONSHIPS

Strong positive relationships were obtained for aluminum silicate minerals, Na- and K-feldspar, and oil content for the oil-rich Mahogany Bed (MB) for both core holes. These relationships are illustrated in histograms shown in Figures 13 and 20.

Strong direct positive relationships between the volume of organic matter and the relative amounts of quartz and Na- and K-feldspar have previously been reported by Robb, Smith, and Trudell (1978) in the saline depositional center of the Piceance Creek Basin. The silicate minerals were also reported to have been directly related to each other. Significant non-correlation with organic matter or any other minerals was found for calcite and analcime in the above referenced report.

Dolomite and quartz concentrations were relatively constant throughout both core holes. Quartz had a positive relationship with dolomite in both the overlying oil shale (OOS) and the MB zones for both core holes. These same two minerals also had a positive relationship in the lower Mahogany Zone (LMZ) of core hole 15/16.

Analcime had positive relationships with quartz in the OOS of both cores. Similar relationships existed for the upper Mahogany Zone (UMZ) for core hole 25 and the rich oil shale zone (ROS) of core hole 15/16. Analcime and assay water exhibited very strong positive relationships in all mineral zones of both cores, except the MB of core hole 15/16. This agrees with the relationship observed and exploited by Desborough and Pitman (1975). These relationships are shown in Figures 13 and 20. The actual water content of analcime, 8.7 percent (Johnson et al., 1975), typically represented about one-third of the Fischer Assay water values. Additionally, analcime had strong negative relationships with K-feldspar in the OOS of both cores, the UMZ of core 15/16, and the MB and lower MZ of core 25.

Calcite had a negative relationship with dolomite in the OOS of both cores, in the LMZ and ROS of core 15/16, and in the MB of core 25. Negative relationships existed between calcite and quartz in all five stratigraphic zones of core 15/16 and in the MB and LMZ of core 25.

Magnesium siderite is not illustrated in the histograms. This mineral was detected in 80 and 50 percent of core holes 15/16 and 25 composite samples, respectively. Positive relationships were obtained between Mg-siderite and K-feldspar in the OOS and LMZ of both cores.

Pyrite was found to be present in 75 and 20 percent of the composite samples of core holes 15/16 and 25, respectively. Pyrite concentrations were a maximum in the oil-rich MB of both core holes. Pyrite had a positive relationship with oil content in the OOS and ROS of core 15/16 and in the MB of core 25.

Relationships were not determined for the four minerals illite, aragonite, dawsonite, and fluorite. Illite, difficult to detect by x-ray diffraction, was found to be present in 25 and 80 percent of the composite samples of cores 15/16 and 25, respectively. Aragonite was present in

20 percent of the core 15/16 samples, and was present primarily in the UMZ, MB, and LMZ. Only two samples in core 25, both in the UMZ, were found to contain aragonite. Dawsonite was not detected in core hole 25 but was detectable in 10 percent of the core 15/16 samples from the UMZ, MB, and LMZ. Fluorite was detected in only two samples of core 15/16.

Figures 9 and 12 illustrate very similar relative minimum-maximum values for dolomite, Na-feldspar, and oil and water content when the results for individual stratigraphic zones of both core holes are compared. The other minerals were more variable.

These much more comprehensive studies yielded results similar to those reported by Brobst and Tucker (1973). However, the following differences were found in the current studies. Both Na- and K-feldspar were present in all samples. Analcime was less abundant in the richer oil shale, in sharp disagreement with Brobst and Tucker (1973). Magnesium siderite was present in most samples. Aragonite occurred in approximately one-third of the samples from the MZ of core 15/16, but in only two samples from core 25. Aragonite has been previously reported (Smith and Robb, 1973) to co-occur with calcite and dolomite as matrix minerals in the Mahogany Zone of the Green River Formation.

ELEMENT, MINERAL, AND ORGANIC RELATIONSHIPS

All of the rare earth elements plus Ga and Ta are associated with Al which is present in the feldspars. The above elements have SSVs of 99.9 percent for nearly all stratigraphic zones in both cores as illustrated in Figure 27. These same relationships are shown in the histograms in Figures 14 and 21. Additionally, Fe, K, Rb, Ti, and K-feldspar have a strong positive relationship with Al for all zones in both cores. The elements Cr, Hf, Sc, Y, and Zn also have a positive relationship with Al in nearly all of the stratigraphic zones for both cores. All of the above mentioned elements, except K and Ti, have very similar relative minimum-maximum element concentration values for the different stratigraphic zones in each core hole. This is illustrated in Figures 7, 8, 10, and 11.

Figures 28 and 29 show SSVs for the other variables with respect to Al. Except for the UMZ in both core holes, Co, Cu, Ni, and V exhibit a strong relationship with Al. Carbonate mineral elements, Ba, mineral carbon, Ca, Mg, and Sr, plus the carbonate minerals calcite and dolomite do not have a positive relationship with Al in any of the stratigraphic zones of either core.

The relative minimum-maximum values of the elements As, Cs, F, K, Hg, Mo, Na, Se, and Zr vary widely in one or more stratigraphic zones from each core hole. This is illustrated in Figures 7, 8, 10, and 11.

Analcime and Na have strong positive relationships in the OOS and UMZ of both cores and the MB of core hole 25. Typically, one-half of the Na in the above stratigraphic zones is from analcime. Sodium feldspar and Na have strong positive relationships in all but one stratigraphic zone of each core hole, the UMZ of core 15/16 and the MB of core 25. The histograms shown in Figures 15 and 22 illustrate the relationship of Na with analcime and Na-feldspar. Cesium is associated with Na in the OOS and MB of both cores and in the LMZ of core 15/16. Rubidium is associated with K, Al, and K-feldspar in all stratigraphic zones.

Arsenic, Se, Hg, Co, Cu, Ni, Pb, Sb, and V all have positive relationships in most of the stratigraphic zones from both cores. This is illustrated in histograms shown in Figures 16, 17, 23, and 24. Figure 33 illustrates that Cu, Ni, Pb, and Sb are associated with Co and have SSVs of 99.9 percent for nearly all stratigraphic zones of both cores. The elements Co, Cu, Ni, Pb, and V all have positive relationships with K- and Na-feldspars in most stratigraphic zones of both core holes. They also have positive relationships with organic carbon and oil content in the oil-rich MB where pyrite is enriched and correlate well with organic carbon. Thus, they may be present as sulfides. Arsenic, Se, and Hg have positive relationships with organic carbon in most stratigraphic zones, as shown in Figures 30 and 35. These three elements most likely are present in several forms, in the inorganic form with Co, Cu, Ni, Pb, and V and in the organic form. These elements reach maximum concentrations in the organic-rich MB, UMZ and MZ. Figures 35 and 38 show that Hg and Sb have strong positive relationships in all stratigraphic zones of both core holes.

The most positive relationships for boron are with K and K-feldspar. This is illustrated in Figure 31.

Calcium has a strong positive relationship with calcite, inorganic carbon, Sr, and Ba. This is shown in Figure 32. The concentration of dolomite is relatively consistent (about 30 percent) in both cores as illustrated in Figures 13 and 20. However, these same figures show that the concentration of calcite varies over a wide range. Thus, calcite is the variable which principally controls fluctuations in the Ca concentrations. Calcium shows a positive relationship with dolomite only in the UMZ of core hole 25.

Magnesium is associated primarily with dolomite in both cores as shown in Figure 36. However, the SSVs for the UMZ of both cores did not reflect this. The only other significant relationships for Mg were with quartz and mineral carbon in some of the stratigraphic zones from each core. Magnesium siderite and Mg had a positive relationship in the UMZ of core hole 15/16 only. The concentration of magnesium siderite is small compared to the relatively constant concentration of dolomite for most samples.

Figure 34 illustrates SSVs obtained for fluorine. Fluorine had almost no significant positive relationships except in the Mahogany Bed of core hole 15/16. Some relationship with Na-feldspar is indicated for two stratigraphic zones of core hole 15/16.

Molybdenum has a strong positive association with organic carbon (Figure 37) in all stratigraphic zones of both cores while uranium has a strong positive relationship with Fischer Assay oil yield in the OOS, UMZ, and MB of both cores (Figure 39). Molybdenum and uranium accumulation may be associated with organic matter.

Figures 19 and 26 are histograms of Fischer Assay oil yield along with H, N, and organic carbon results for both cores. The ratio of H to $(H + N + C_{org})$ is very constant (0.12) throughout both cores. This corresponds to a H to C atomic weight ratio of 1.7. It should be noted that H is present in both the organic fraction and with the water. However, the bulk of the H is in the organic fraction. The ratio of N to $(H + N + C_{org})$ was more variable in both cores, particularly so in core hole 15/16. The ratio was typically in the range of 0.04 to 0.05. Fischer Assay oil content ratioed to $(H + N + C_{org})$ was consistently about 0.65 throughout both cores.

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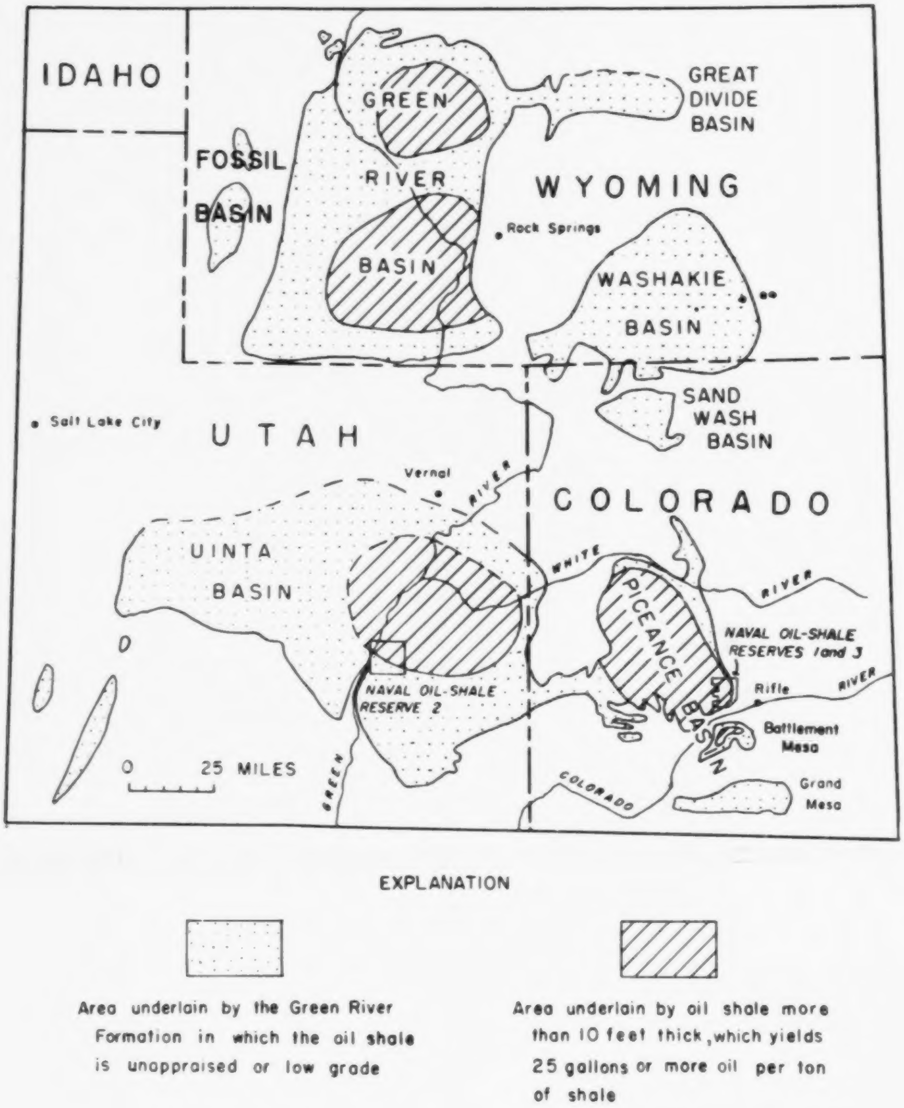
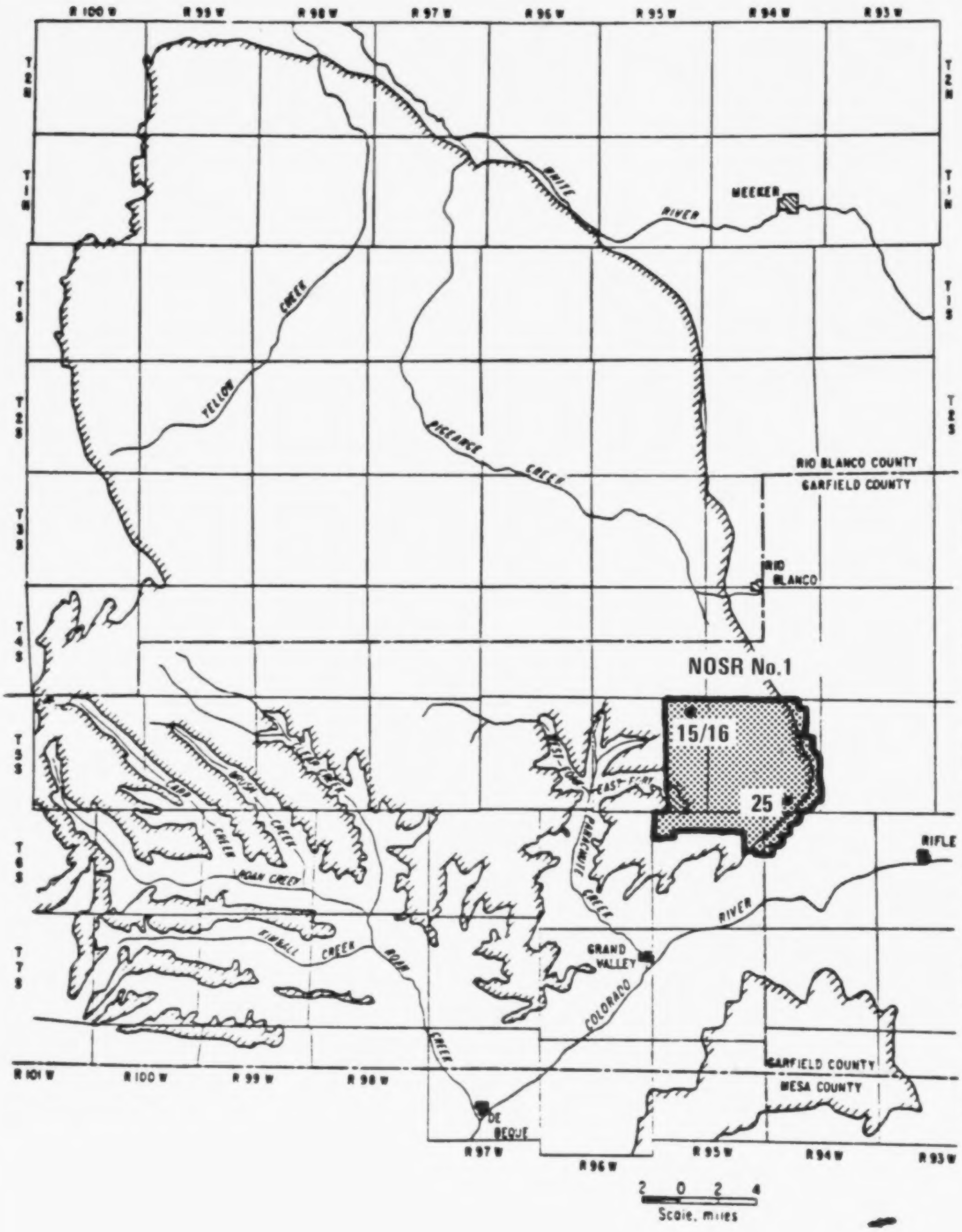

IDAHO
FOSSIL BASIN
GREEN RIVER BASIN
GREAT DIVIDE BASIN
WYOMING
Rock Springs
WASHAKIE BASIN
SAND WASH BASIN
Salt Lake City
UTAH
Vernal
RIVER
COLORADO
UINTA BASIN
WHITE
RIVER
PICEANCE BASIN
NAVAL OIL-SHALE RESERVES 1 and 3
Rifle
RIVER
NAVAL OIL-SHALE RESERVE 2
Battlement Mesa
0 25 MILES
GREEN
COLORADO
Grand Mesa
EXPLANATION
Area underlain by the Green River Formation in which the oil shale is unappraised or low grade
Area underlain by oil shale more than 10 feet thick, which yields 25 gallons or more oil per ton of shale

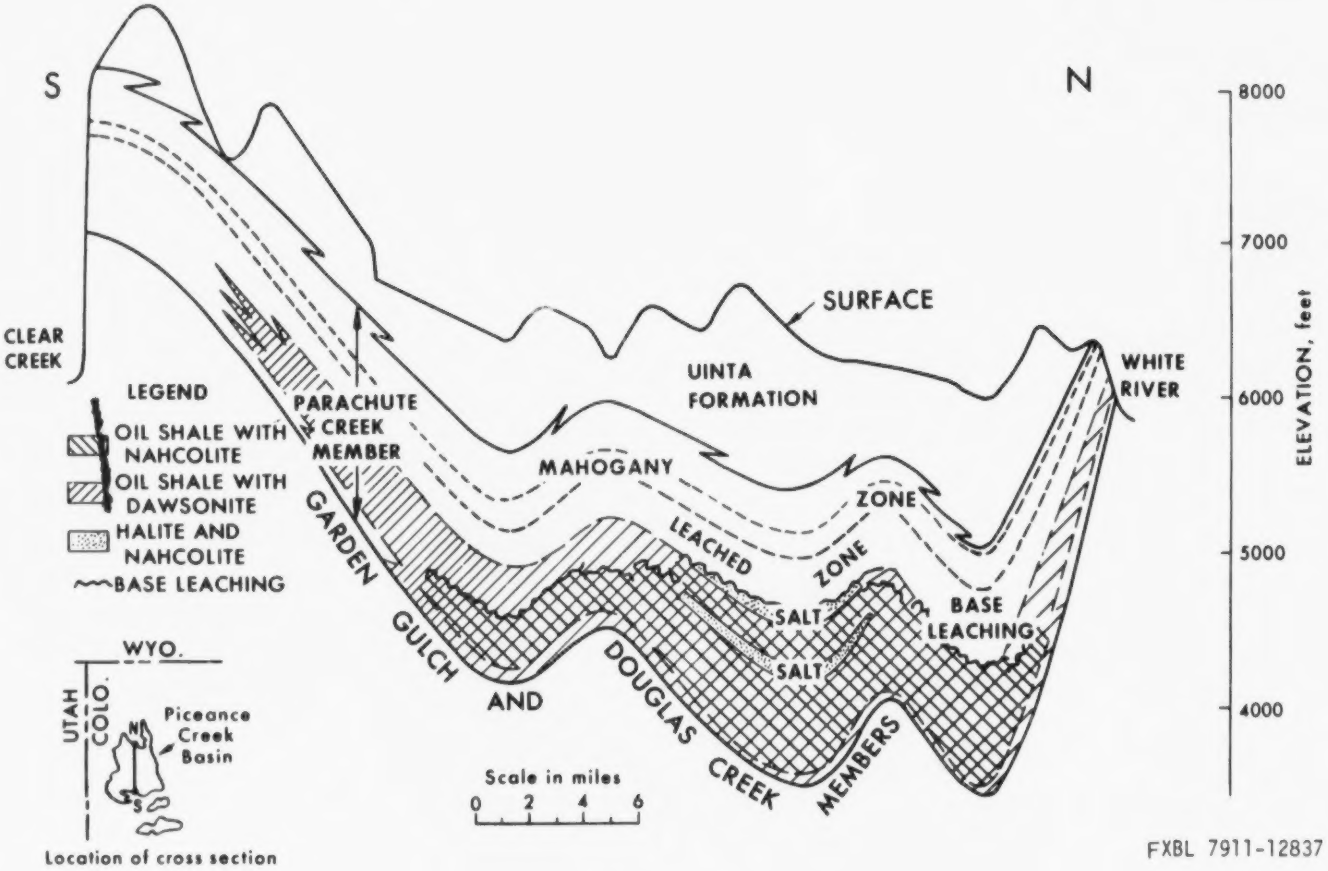
FXBL 789-10883

Figure 1. Oil shale deposites in the Green River Formation of Colorado, Utah, and Wyoming.


R 100 W
R 99 W
R 98 W
R 97 W
R 96 W
R 95 W
R 94 W
R 93 W
T 2 N
T 1 N
T 1 S
T 2 S
T 3 S
T 4 S
T 5 S
T 6 S
T 7 S
T 8 S
WHITE RIVER
MEEKER
YELLOW CREEK
PICEANCE CREEK
RIO BLANCO COUNTY
GARFIELD COUNTY
RIO BLANCO
NOSR No.1
15/16
25
EAST FORK
PARACHUTE CREEK
RIFLE
ROAN CREEK
KIMBALL CREEK
GRAND VALLEY
COLORADO RIVER
GARFIELD COUNTY
MESA COUNTY
DE BEQUE
R 101 W
R 100 W
R 99 W
R 98 W
R 97 W
R 96 W
R 95 W
R 94 W
R 93 W
2 0 2 4
Scale, miles

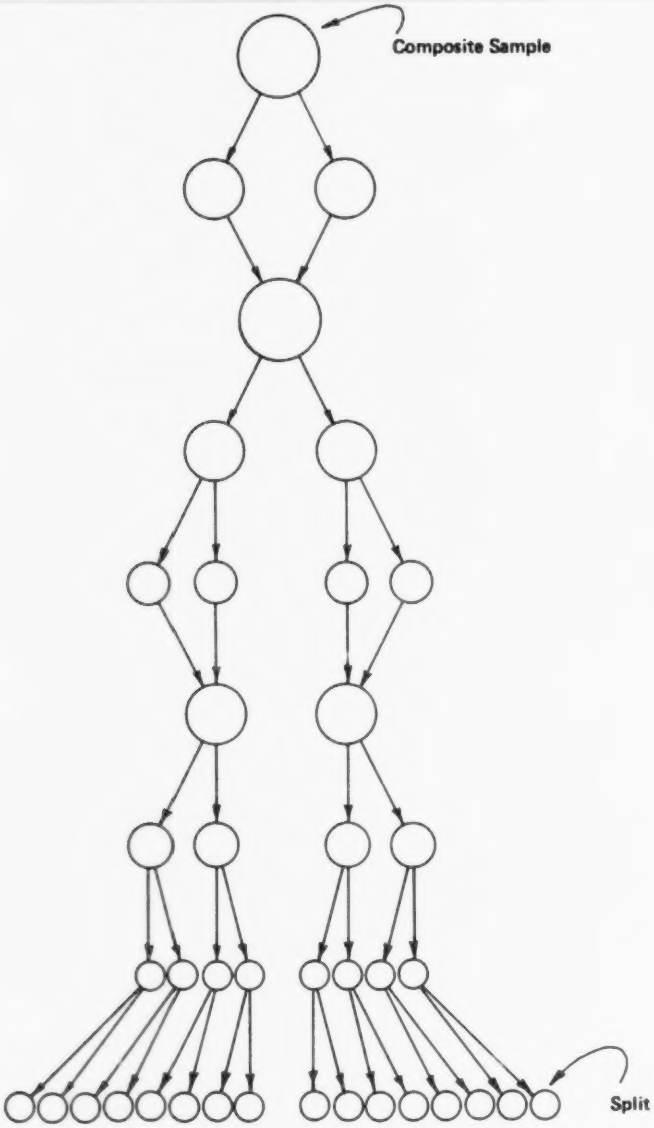
FXBL 808-11490

Figure 2. Location of the Naval Oil Shale Reserve No. 1 and core holes 15/16 and 25.


S
N
CLEAR CREEK
WHITE RIVER
SURFACE
UINTA FORMATION
PARACHUTE CREEK MEMBER
MAHOGANY
ZONE
LEACHED
ZONE
SALT
SALT
BASE LEACHING
GARDEN GULCH AND DOUGLAS CREEK MEMBERS
LEGEND
OIL SHALE WITH NAHCOLITE
OIL SHALE WITH DAWSONITE
HALITE AND NAHCOLITE
BASE LEACHING
WYO.
UTAH
COLO.
N
S
Piceance Creek Basin
Location of cross section
Scale in miles
0
2
4
6
8000
7000
6000
5000
4000
ELEVATION, feet

FXBL 7911-12837

Figure 3. South-north diagrammatic cross-section of the Green River Formation in Colorado's Piceance Creek Basin.


Composite Sample
Split

FXBL 808-11491

Figure 4. Schematic of composite sample splitting technique.

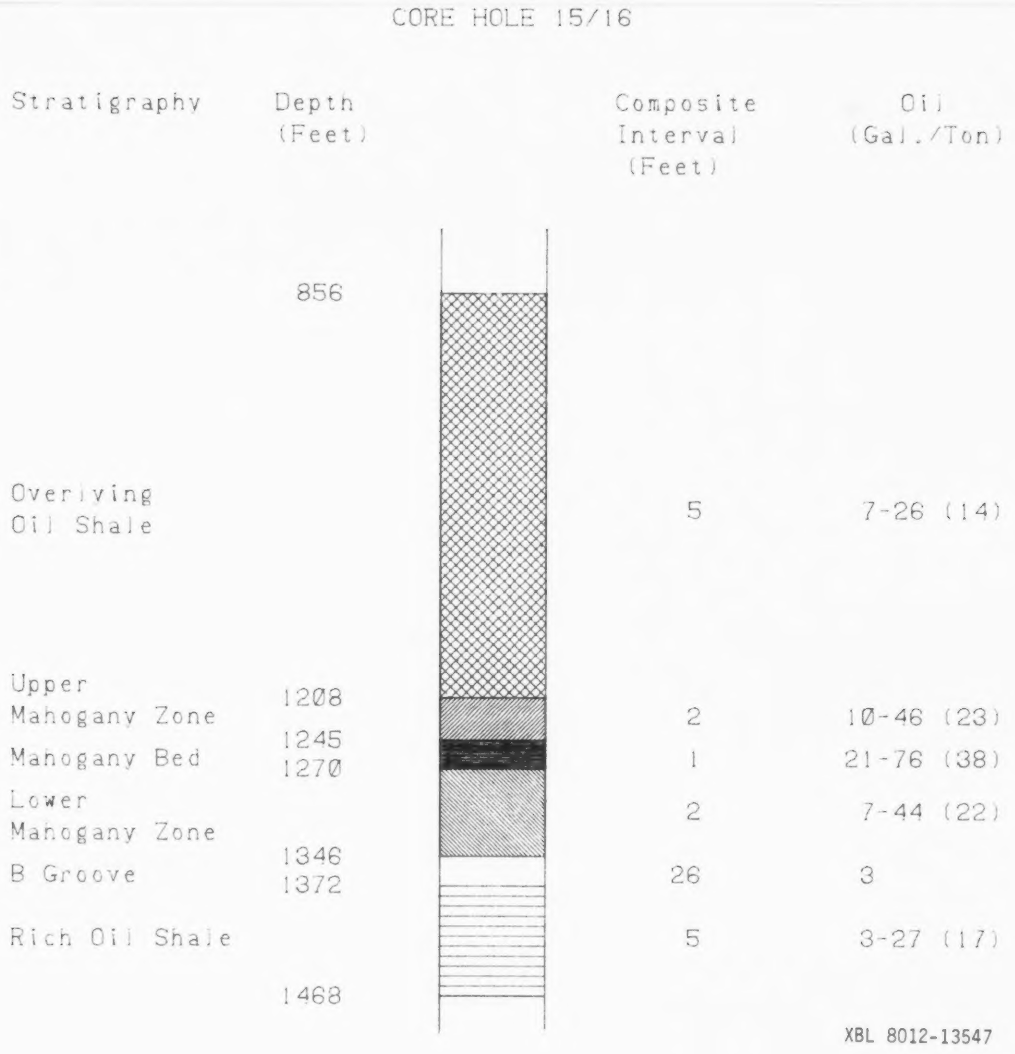


Figure 5. Stratigraphic zones, depth of zones, and composite sampling for core hole 15/16.

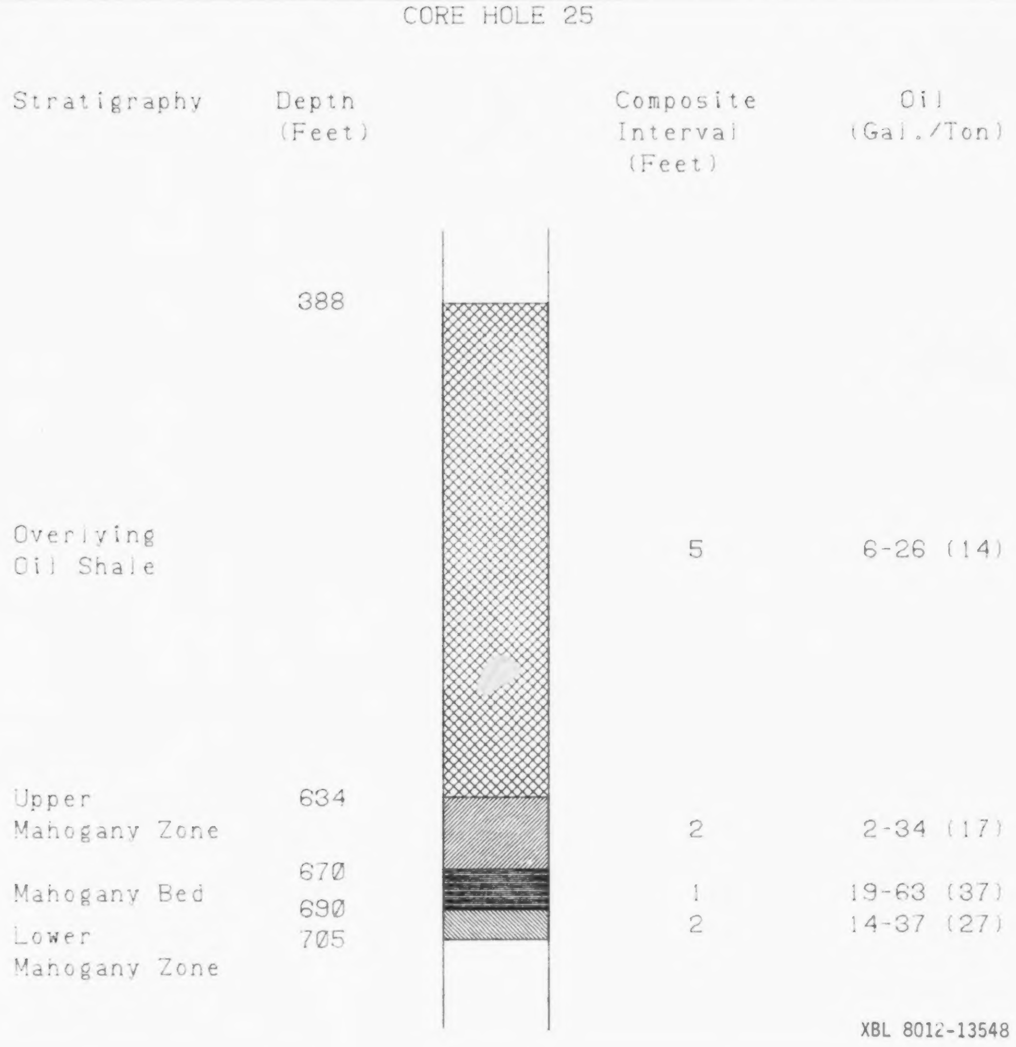
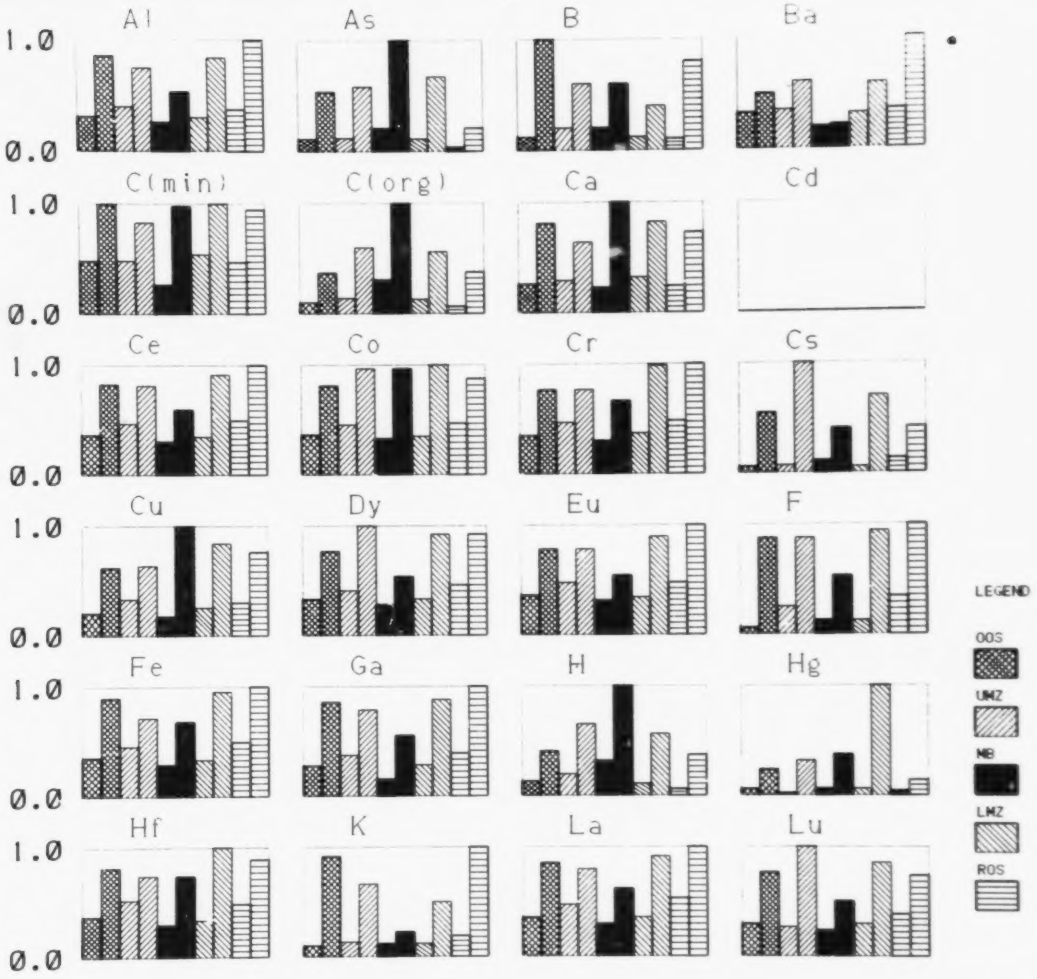
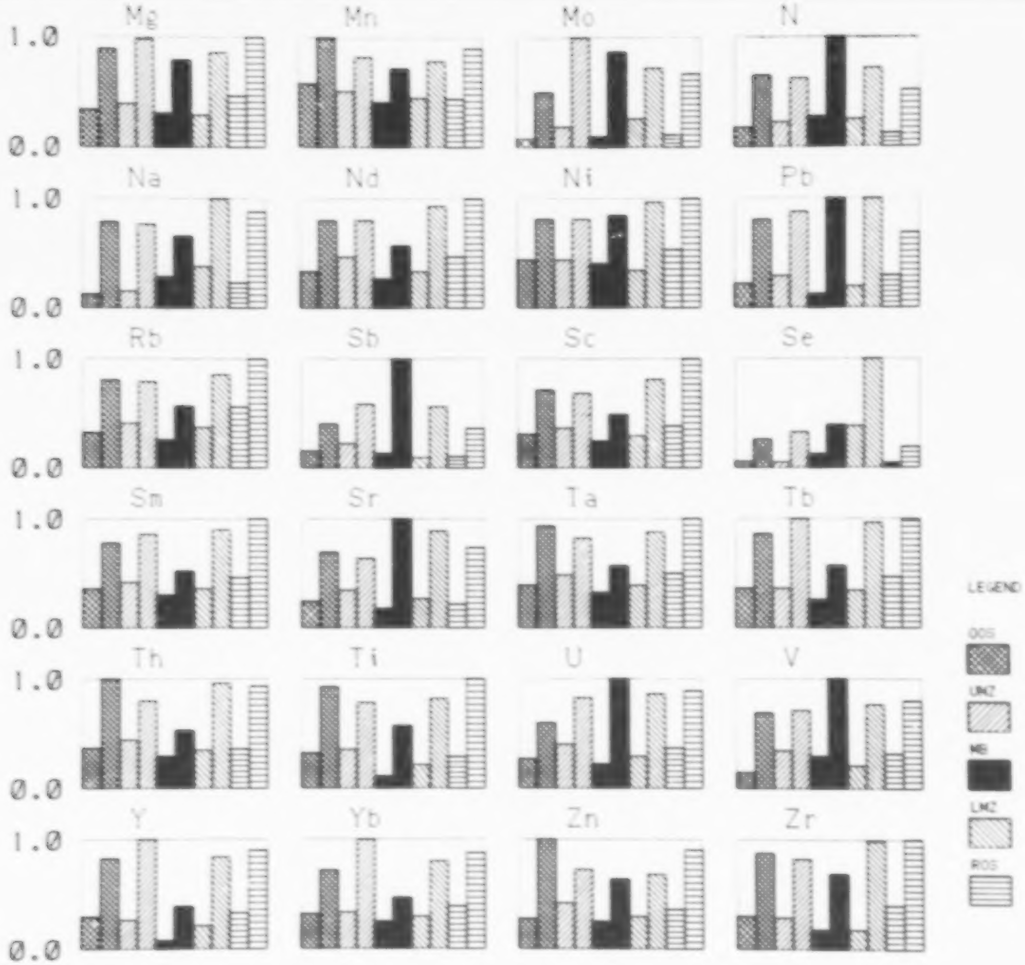

CORE HOLE 25
Stratigraphy
Depth (Feet)
Composite Interval (Feet)
Oil (Gal./Ton)
388
Overlying Oil Shale
5
6-26 (14)
Upper Mahogany Zone
634
2
2-34 (17)
670
Mahogany Bed
690
1
19-63 (37)
Lower Mahogany Zone
705
2
14-37 (27)
XBL 8012-13548

Figure 6. Stratigraphic zones, depth of zones, and composite sampling for core hole 25.



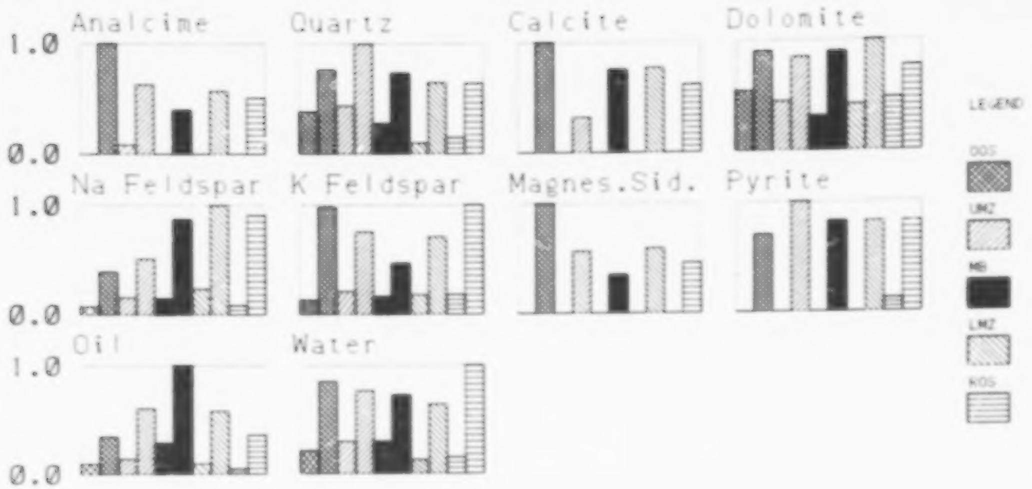
FXBL 804-9085

Figure 7. Relative minimum-maximum element concentration values for five stratigraphic zones of core hole 15/16.



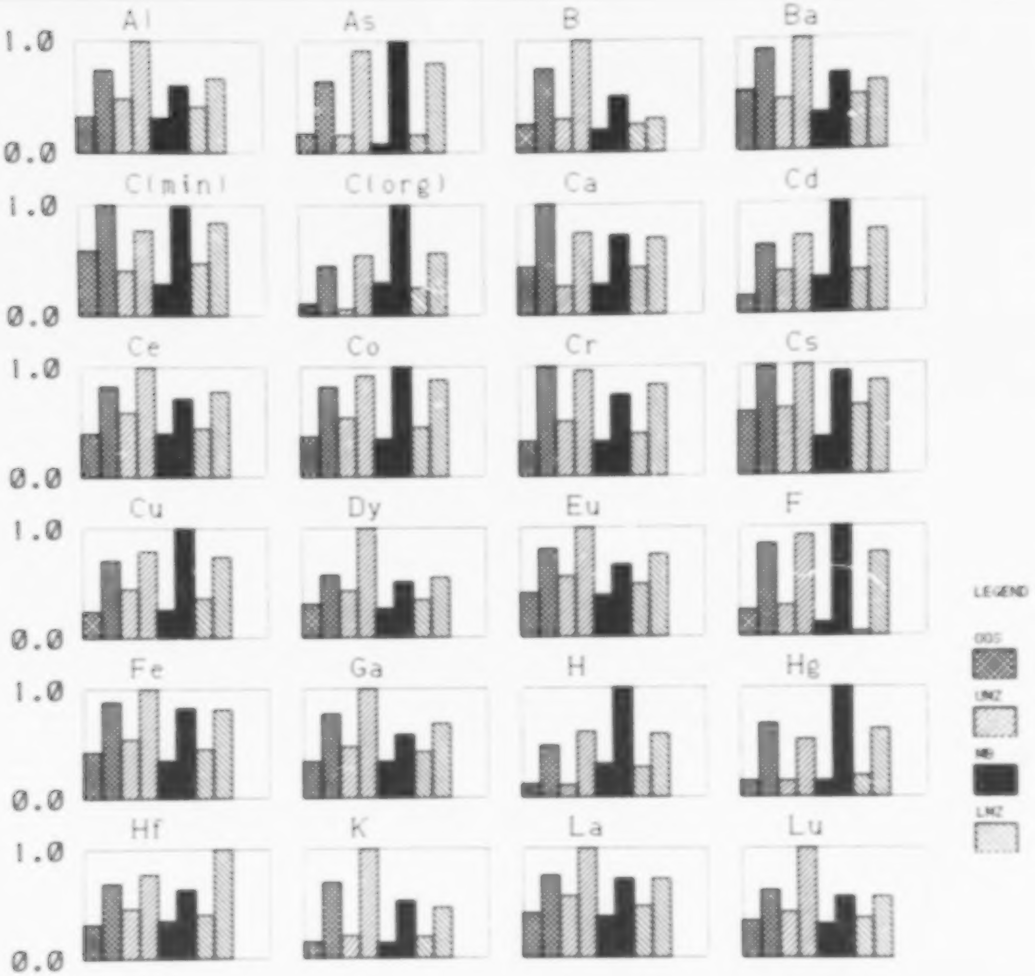
FXBL 804-9086

Figure 8. Relative minimum-maximum element concentrations values for five stratigraphic zones of core hole 15/16.



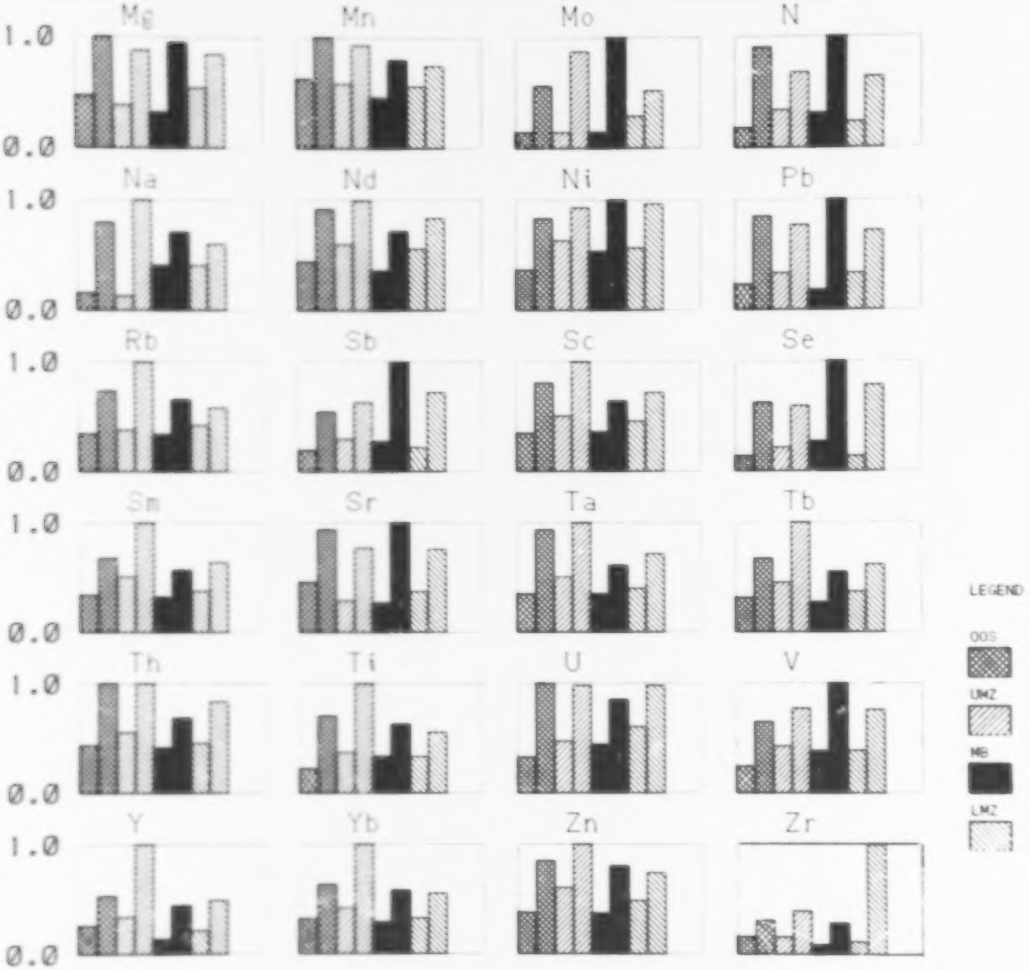
FXBL 804-9084

Figure 9. Relative minimum-maximum mineral and Fischer Assay values for five stratigraphic zones of core hole 15/16.



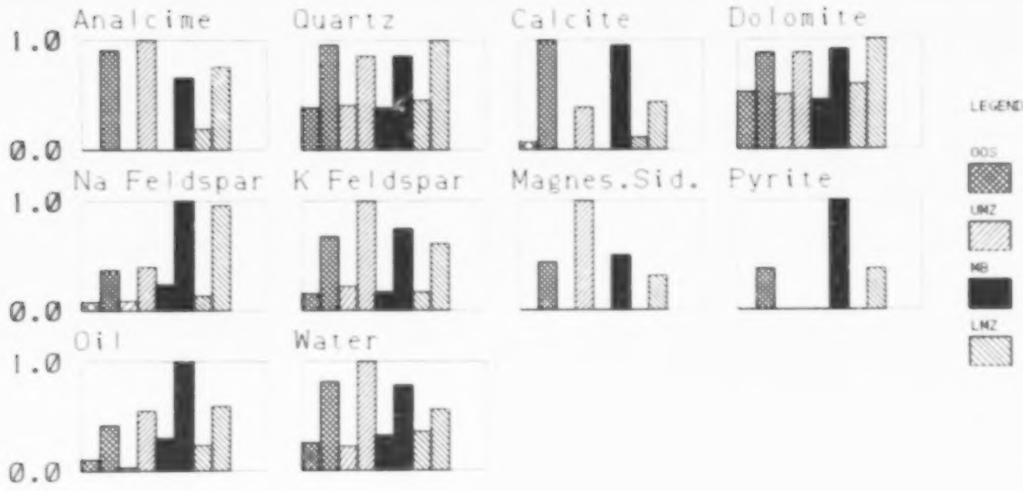
FXBL 804-9083

Figure 10. Relative minimum-maximum element concentration values for four stratigraphic zones of core hole 25.



FXBL 804-9087

Figure 11. Relative minimum-maximum element concentration values for four stratigraphic zones of core hole 25.



FXBL 804-9088

Figure 12. Relative minimum-maximum mineral and Fischer Assay values for four stratigraphic zones of core hole 25.

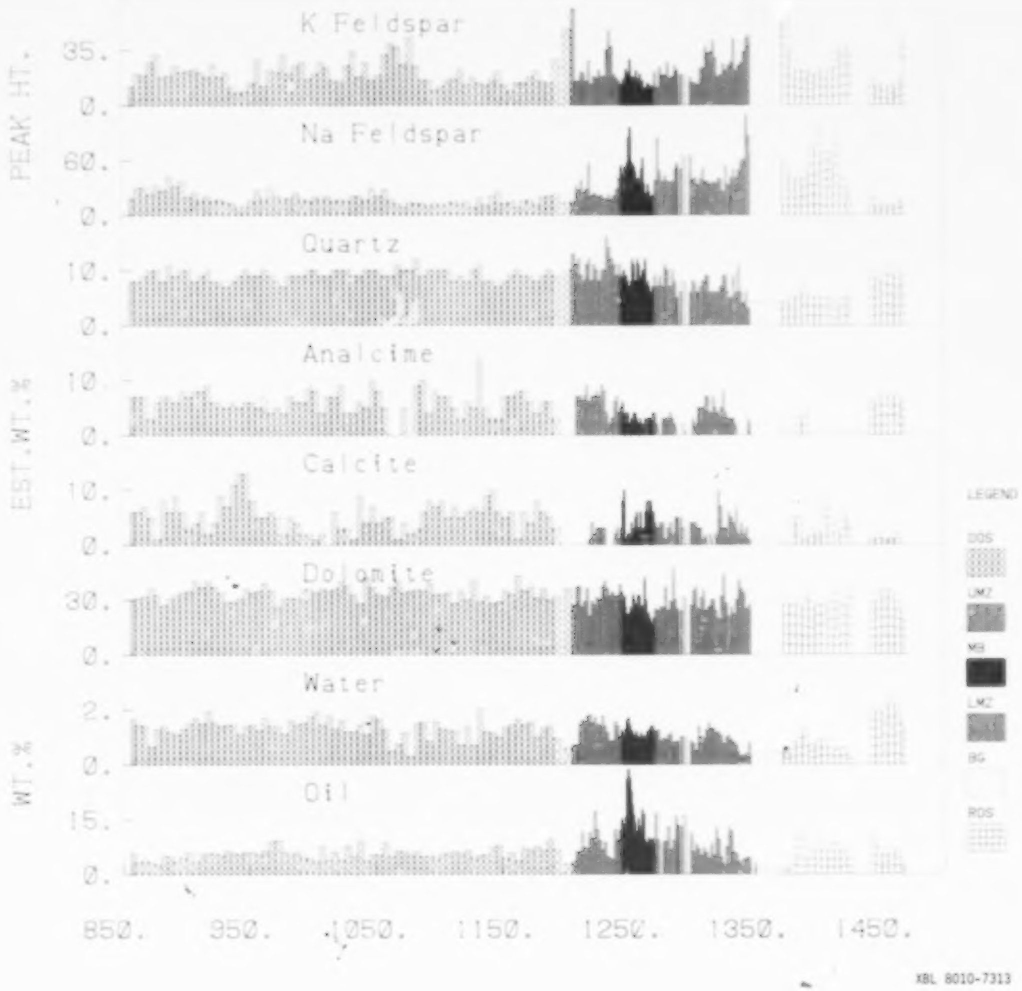
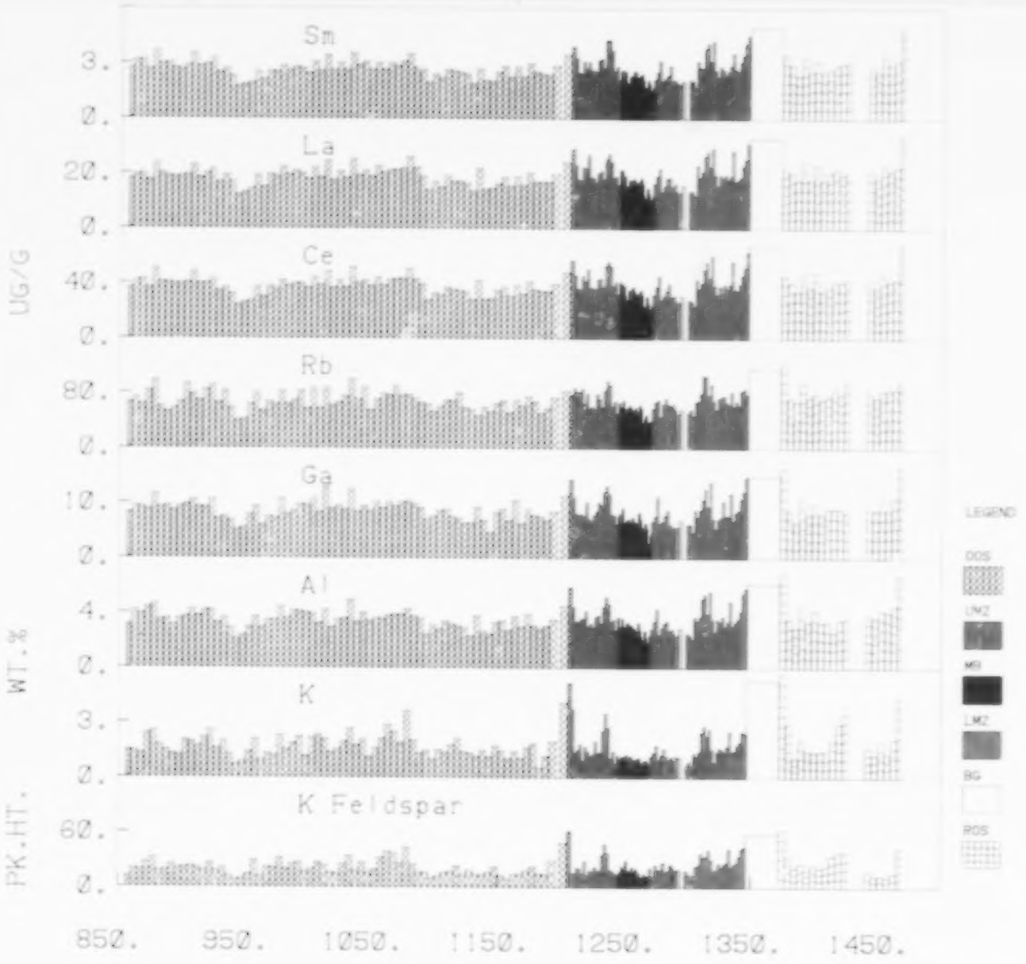
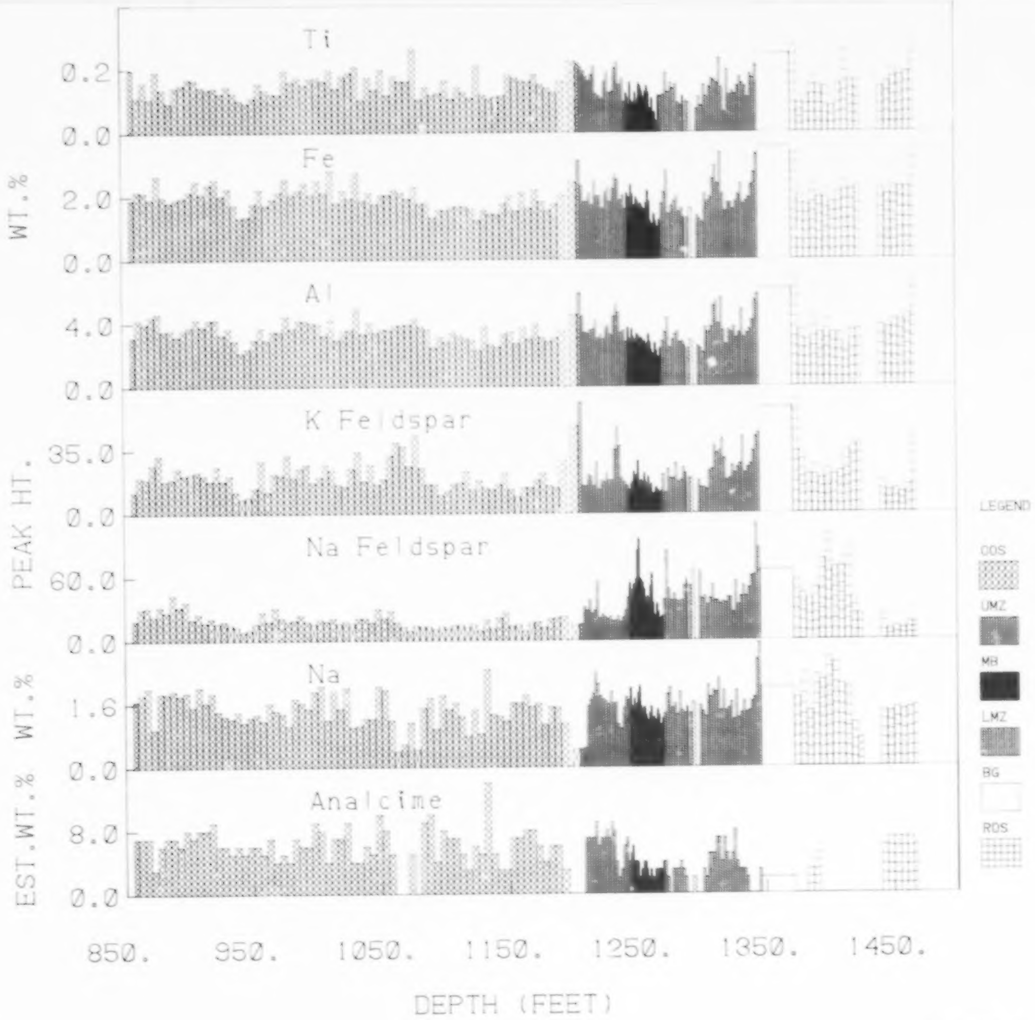


Figure 13. Vertical variation in core hole 15/16.



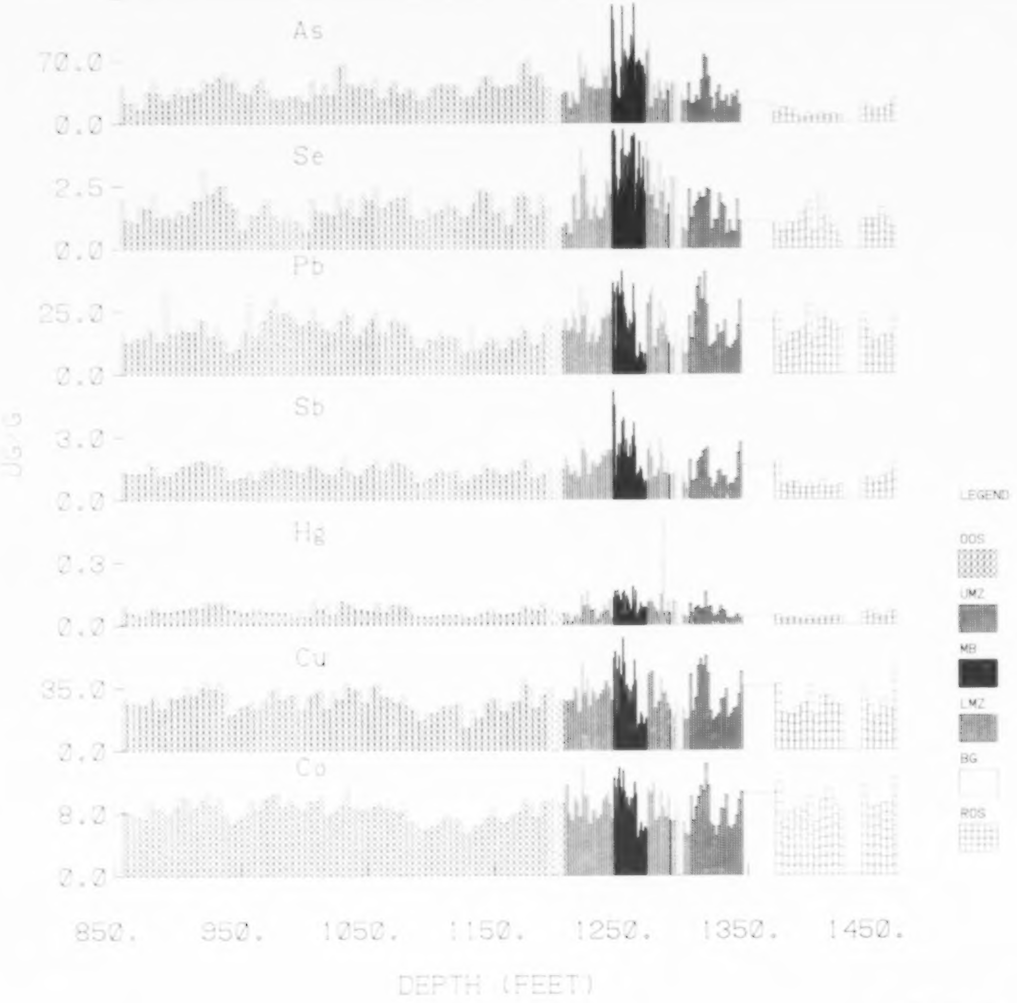
XBL 8010-7311

Figure 14. Vertical variation in core hole 15/16.



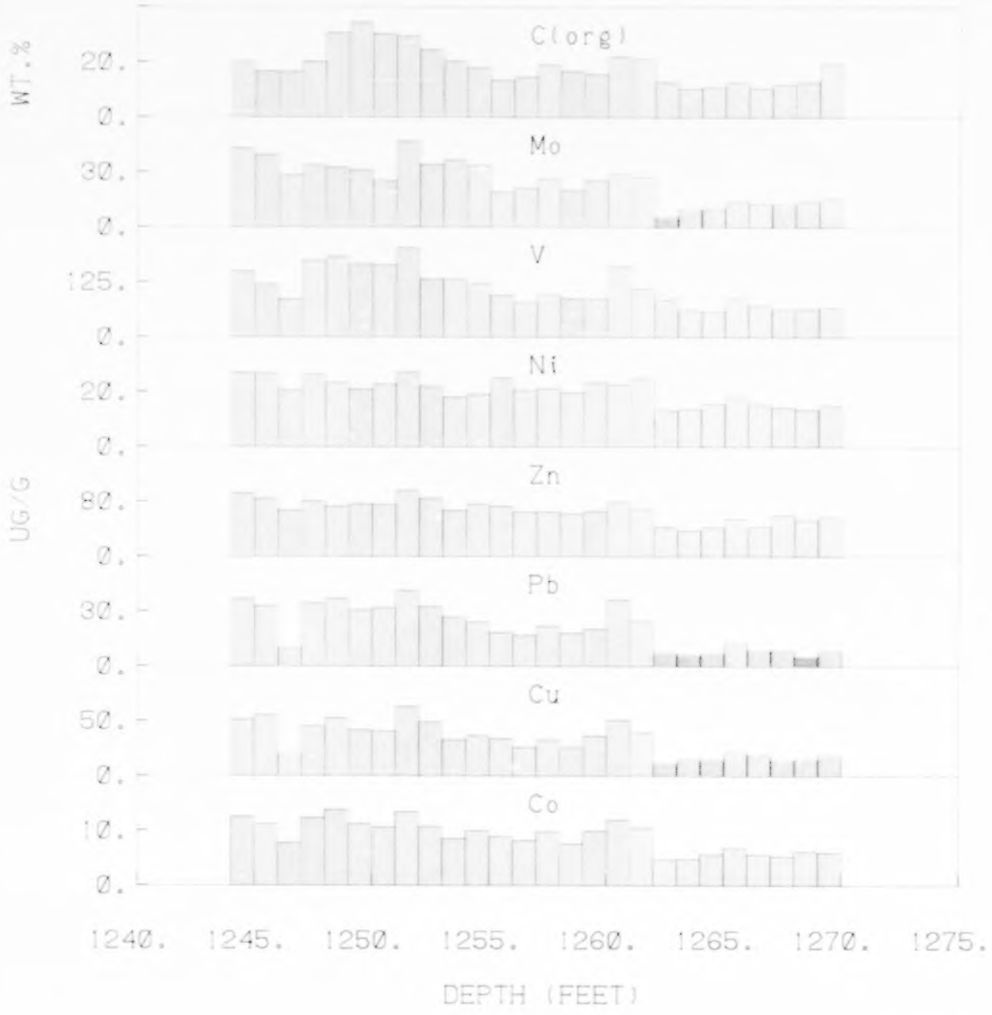
XBL 8010-7308

Figure 15. Vertical variation in core hole 15/16.



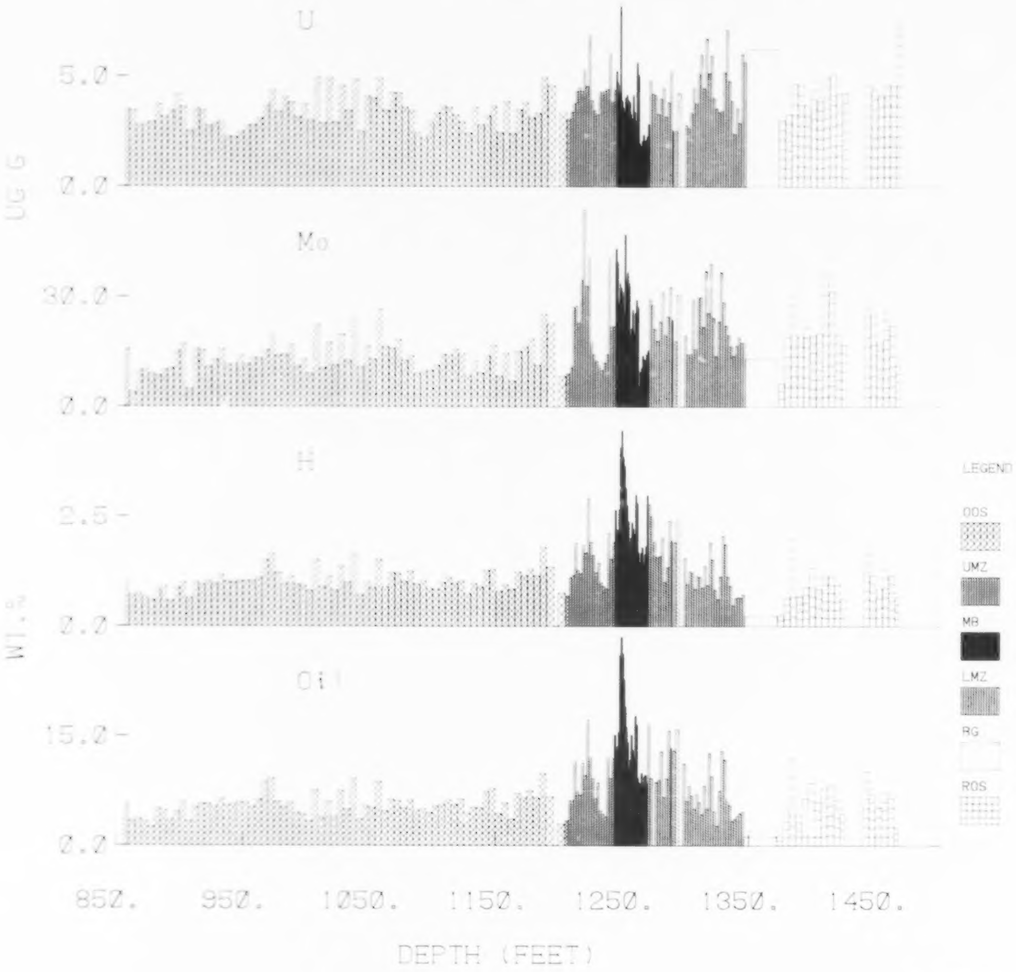
XBL 8010-7312

Figure 16. Vertical variation in core hole 15/16.



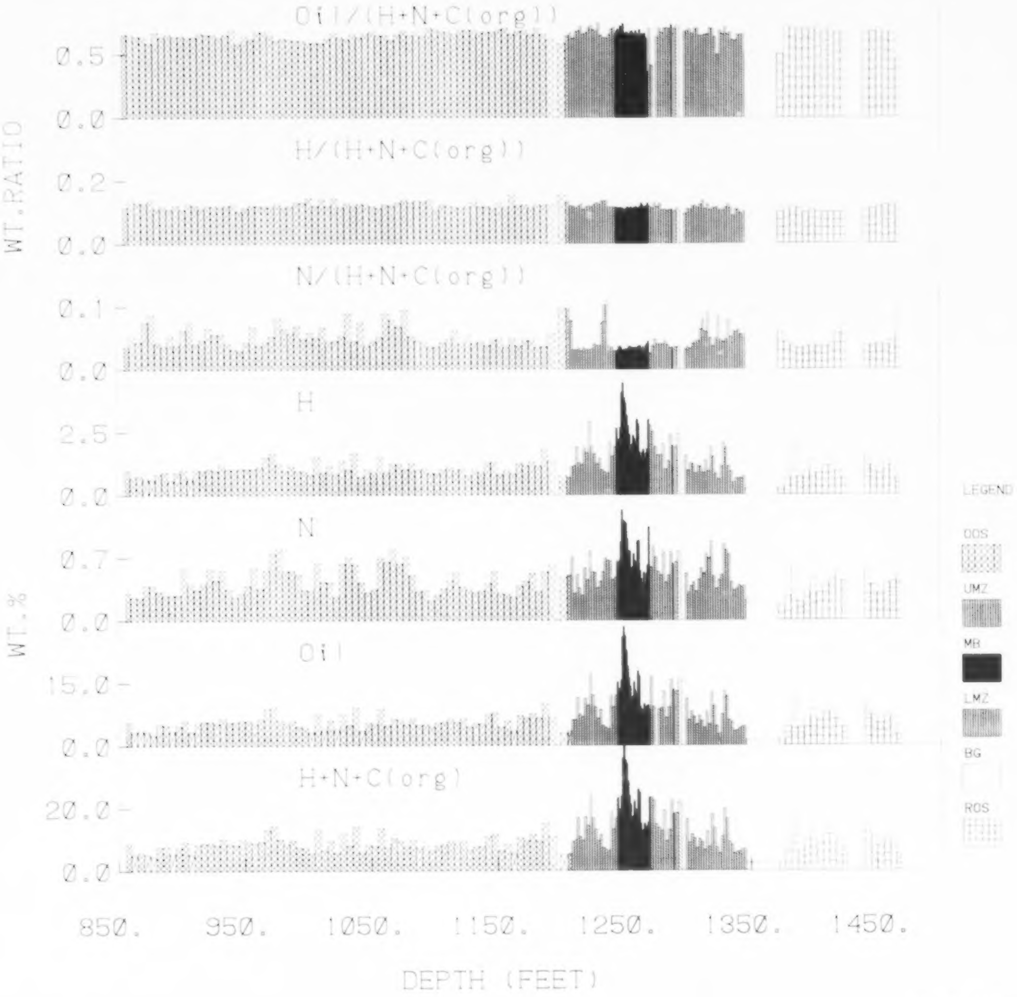
XBL 8010-7309

Figure 17. Vertical variation in core hole 15/16.



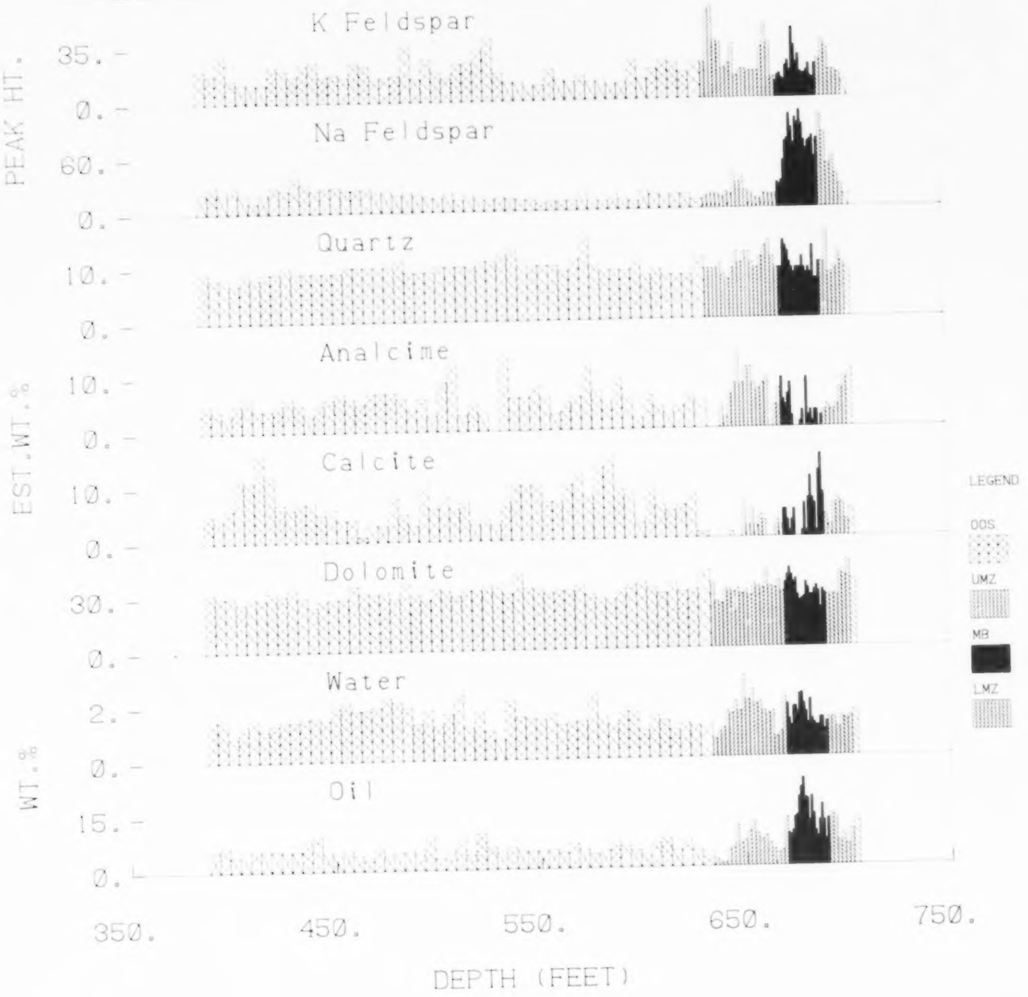
XBL 8010-7307

Figure 18. Vertical variation in core hole 15/16.



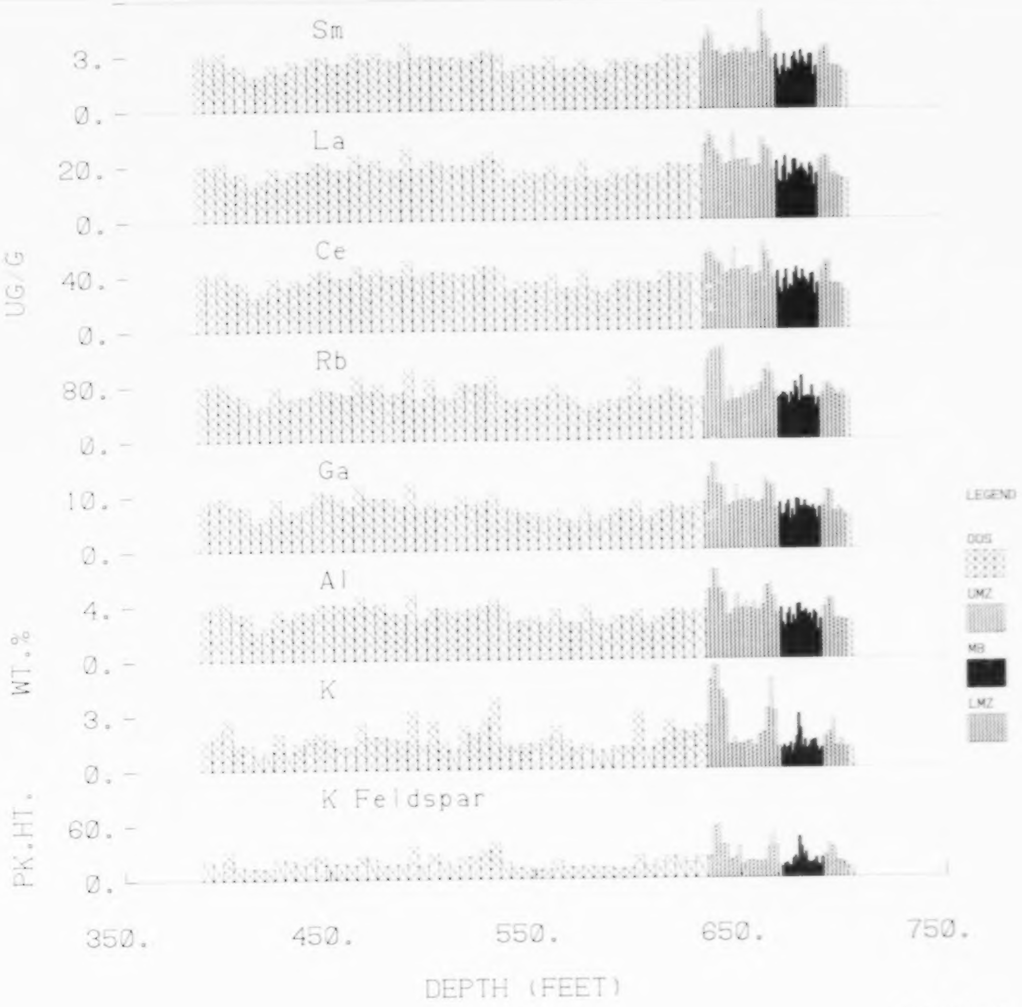
XBL 8010-7310

Figure 19. Vertical variation in core hole 15/16.



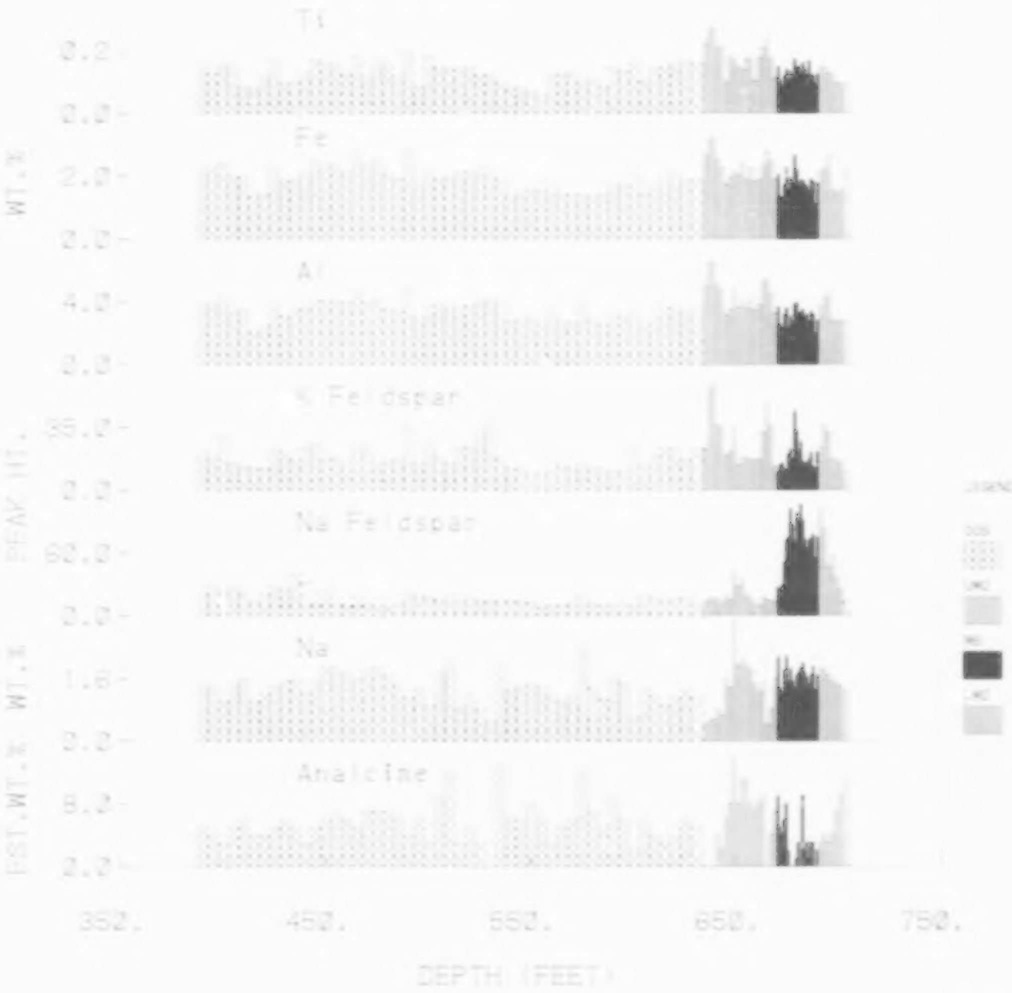
XBL 8010-7327

Figure 20. Vertical variation in core hole 25.



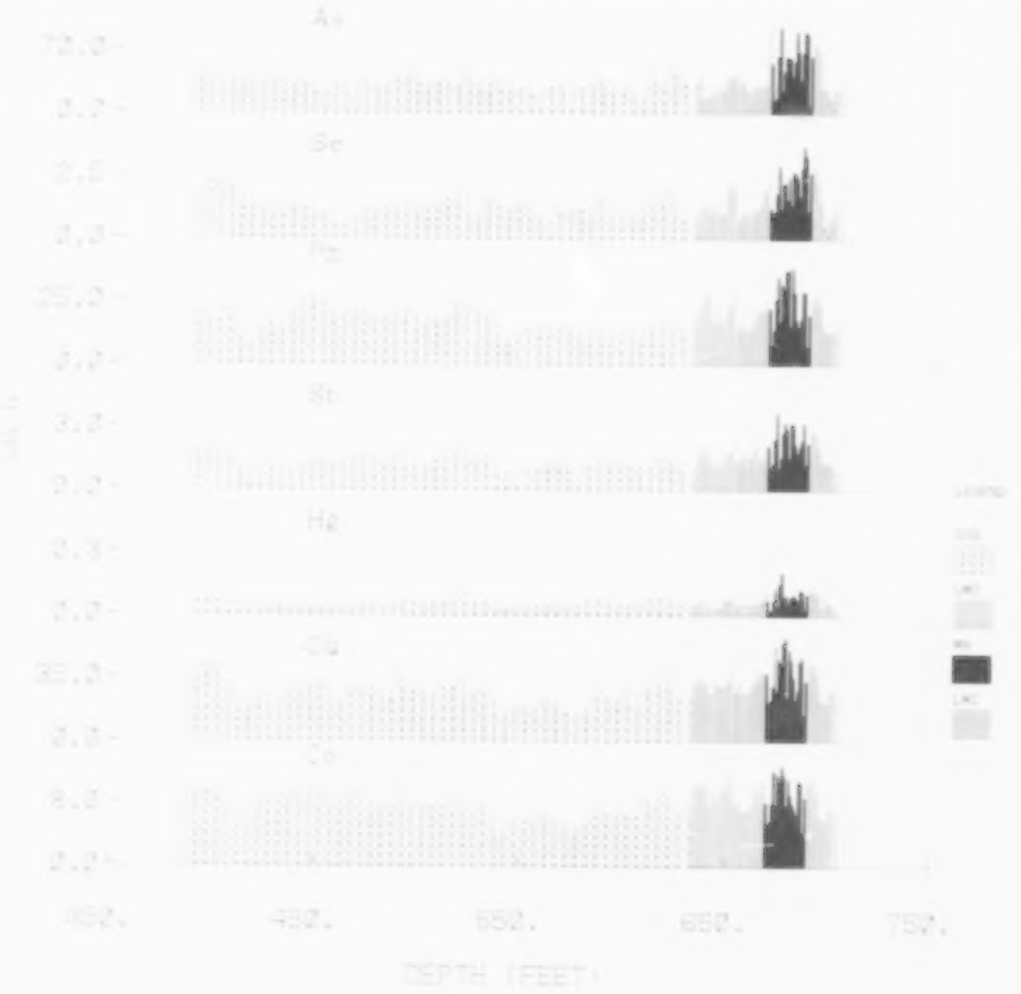
XBL 8010-7325

Figure 21. Vertical variation in core hole 25.



XBL 8010-7302

Figure 22. Vertical variation in core hole 25.



XBL 8010-7326

Figure 23. Vertical variation in core hole 25.

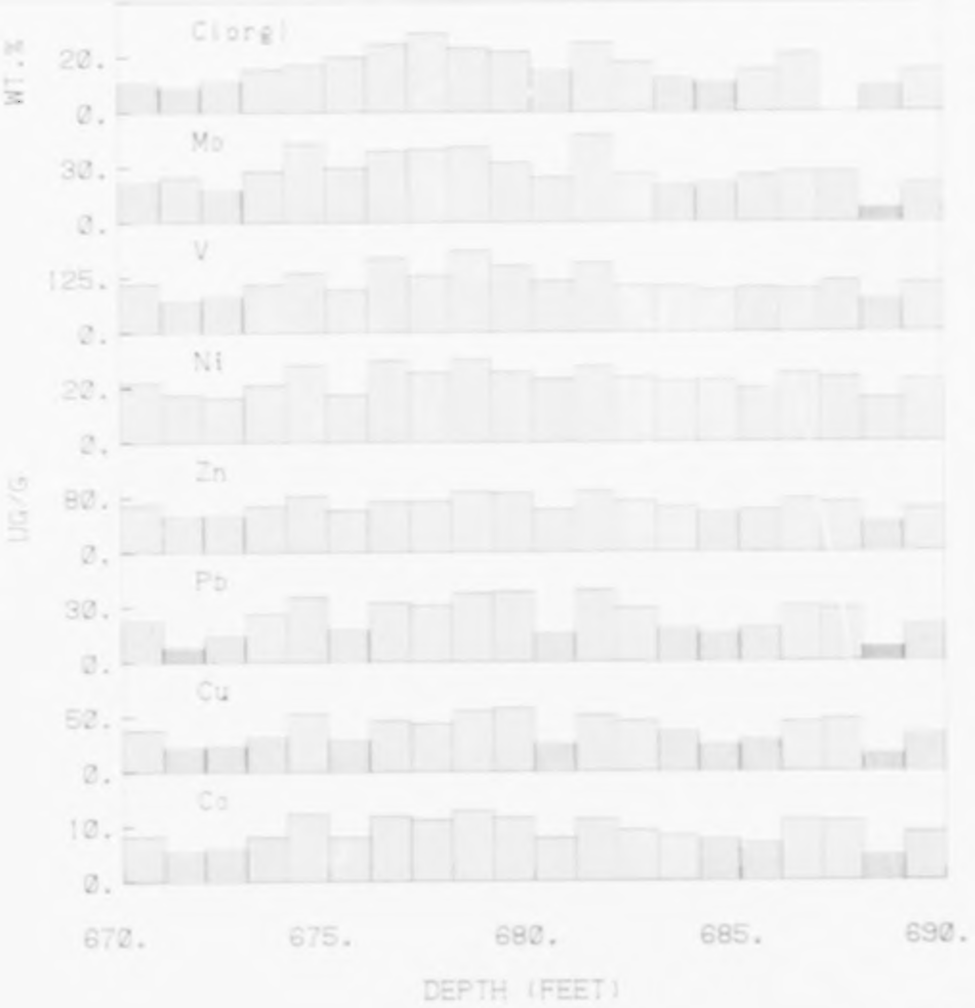
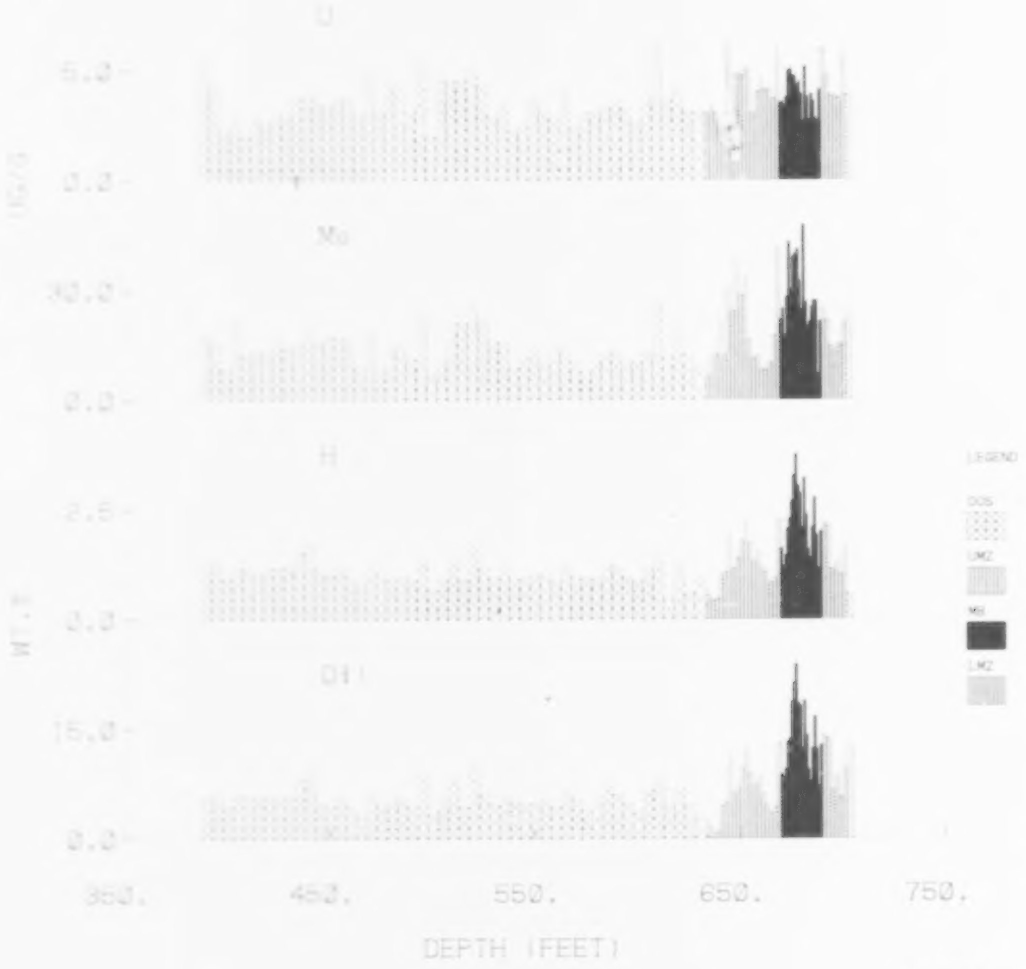
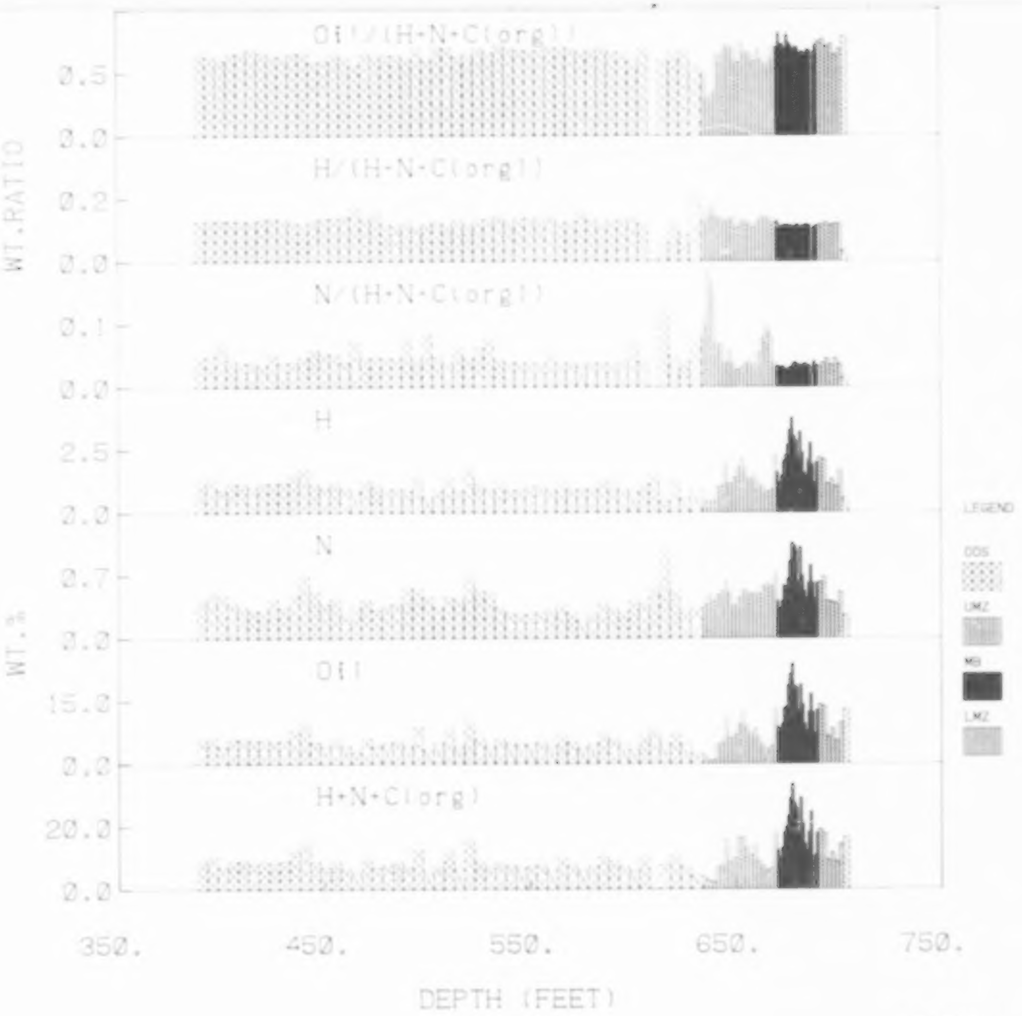


Figure 24. Vertical variation in core hole 25.



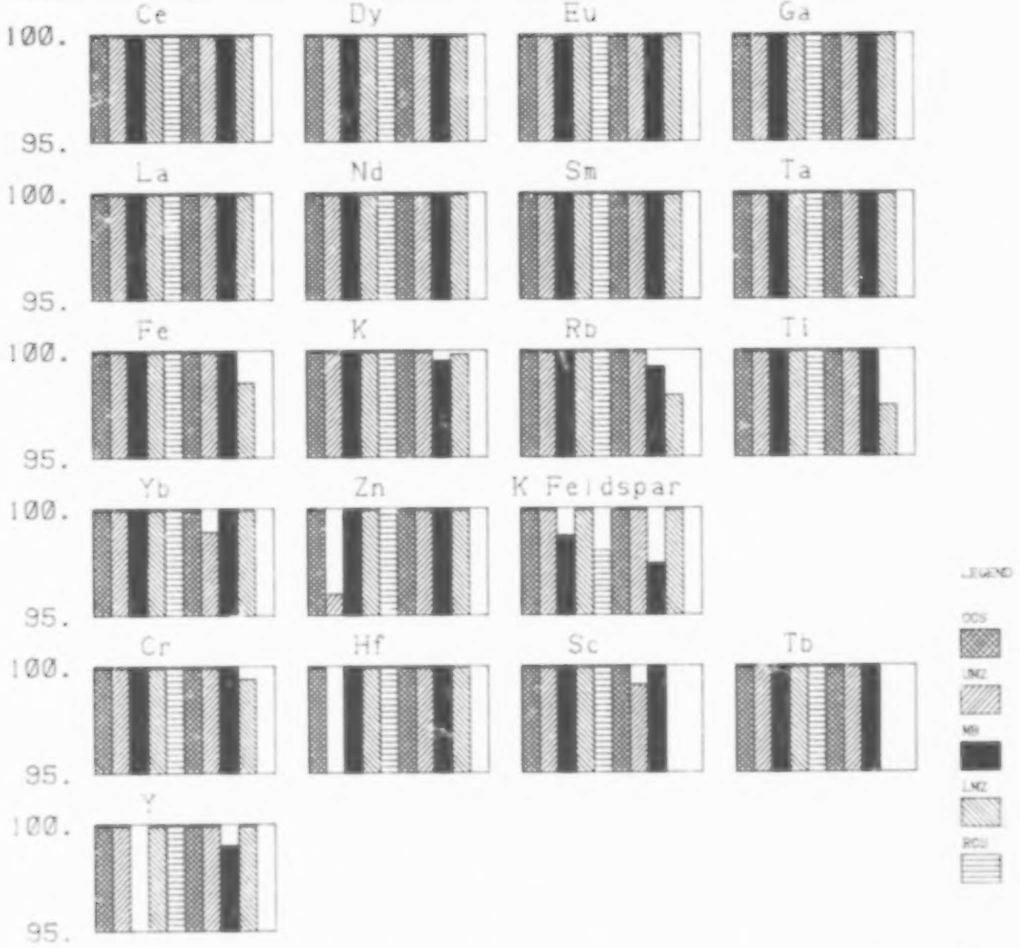
XBL 8010-7321

Figure 25. Vertical variation in core hole 25.



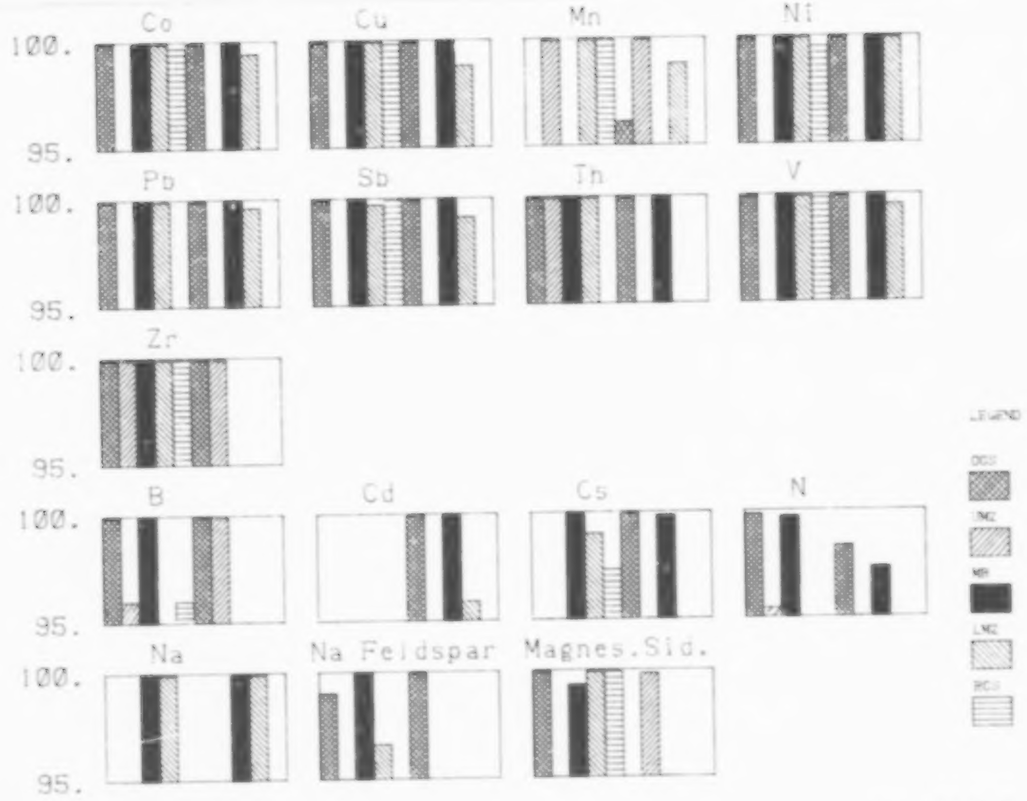
XBL 8010-7324

Figure 26. Vertical variation in core hole 25.



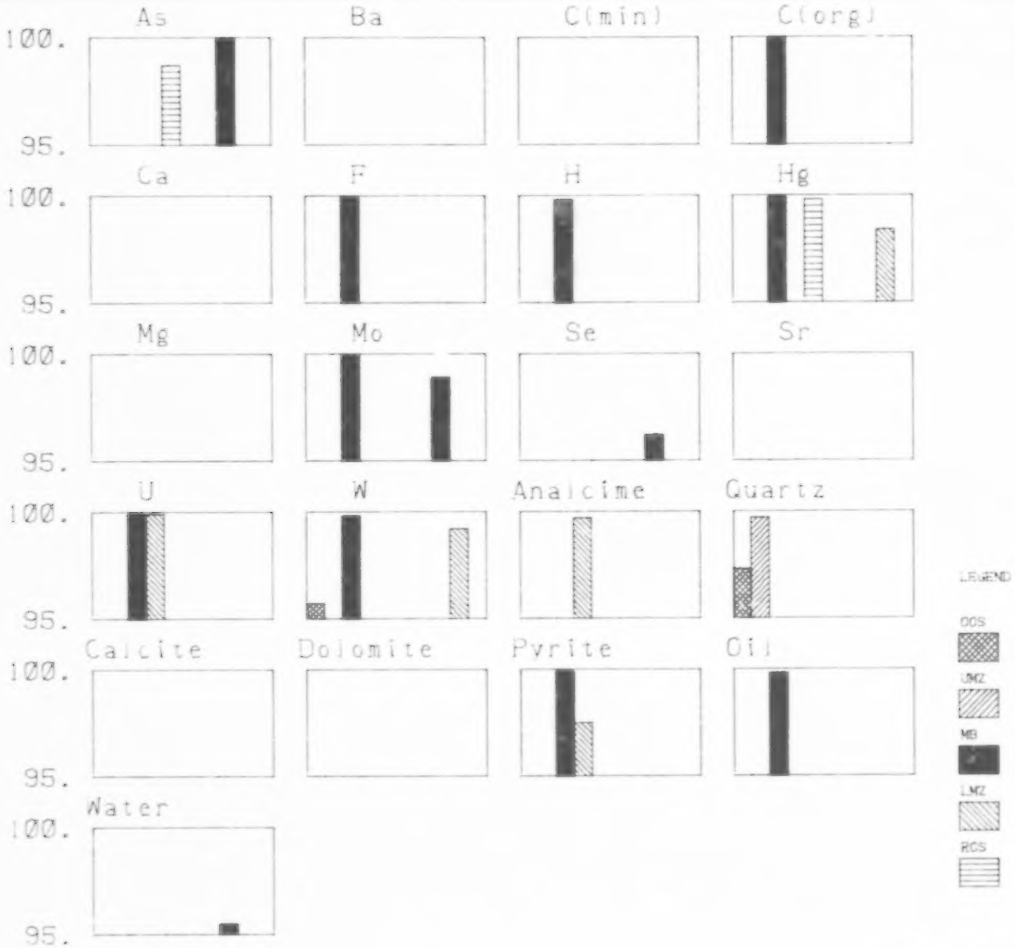
XBL 8010-7341

Figure 27. Statistical significance values for aluminum. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.



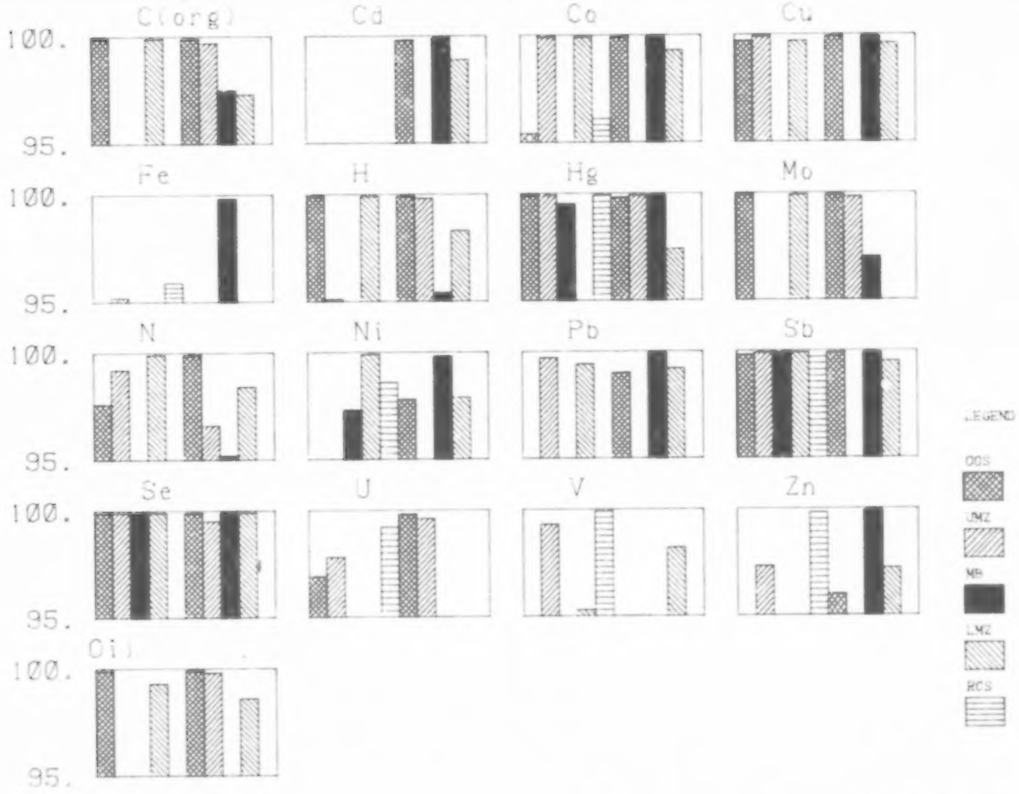
XBL 8010-7340

Figure 28. Statistical significance values for aluminum. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.



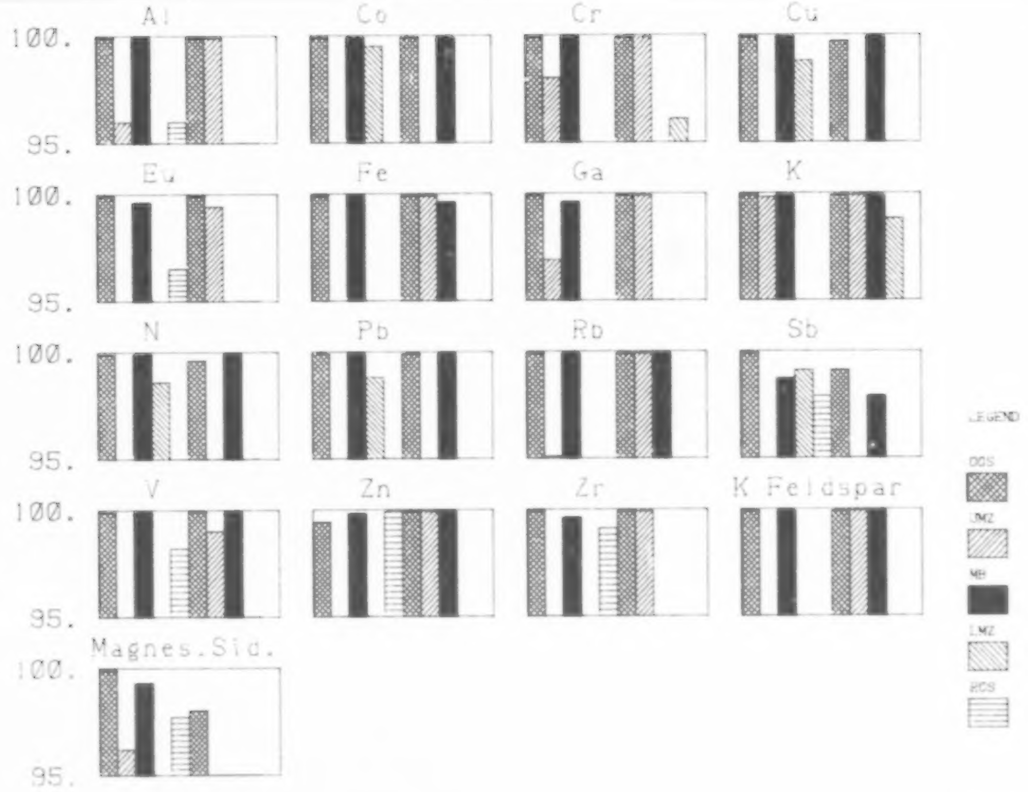
XBL 8010-7339

Figure 29. Statistical significance values for aluminum. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.



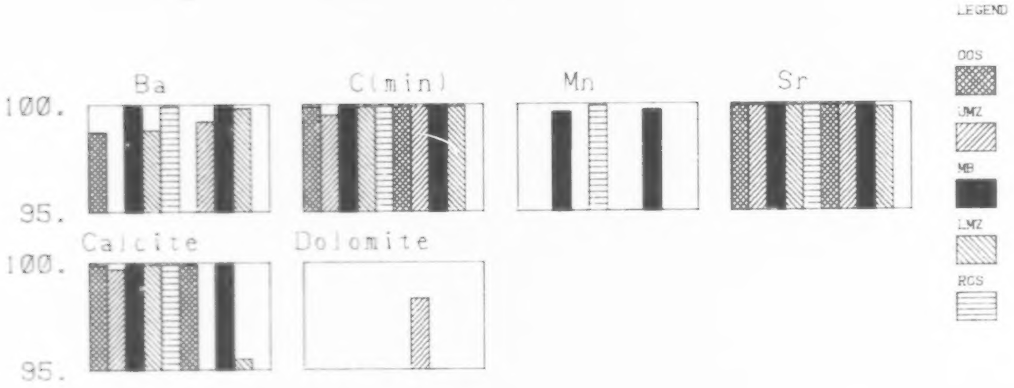
XBL 8010-7337

Figure 30. Statistical significance values for arsenic. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.



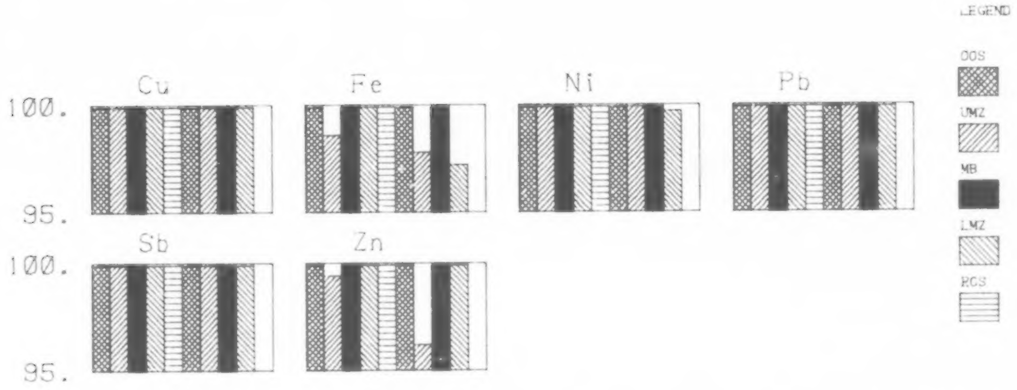
XBL 8010-7331

Figure 31. Statistical significance values for boron. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.



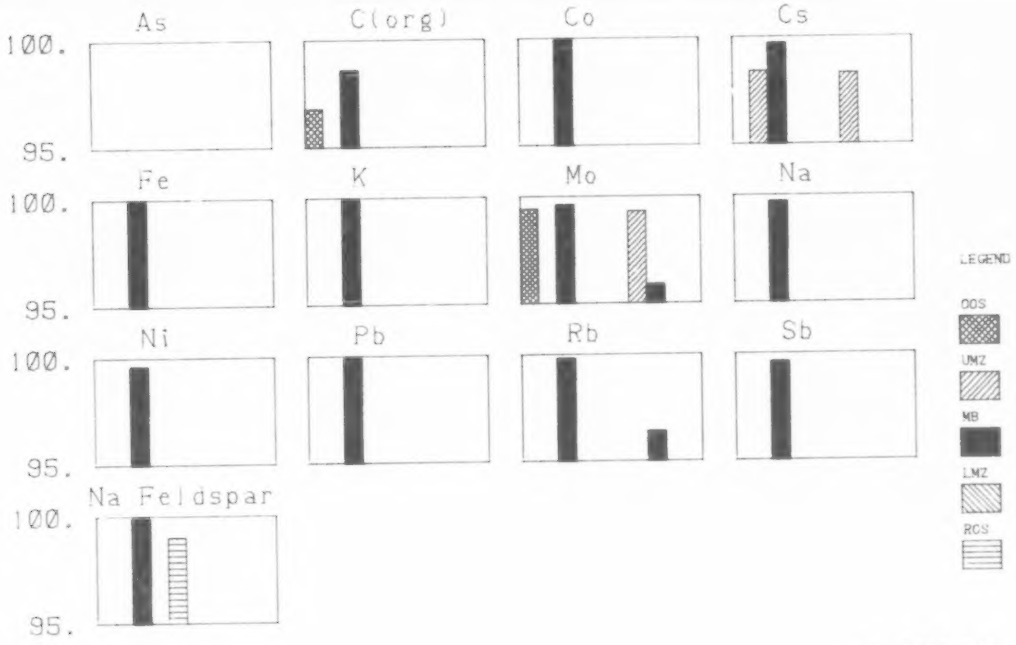
XBL 8010-7329

Figure 32. Statistical significance values for calcium. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.



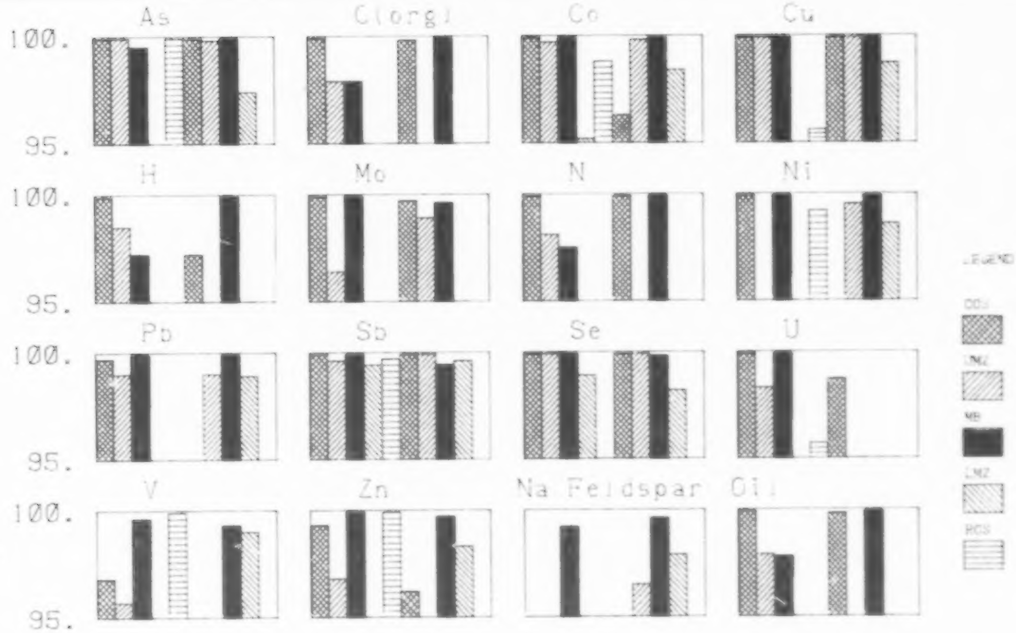
XBL 8010-7338

Figure 33. Statistical significance values for cobalt. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.



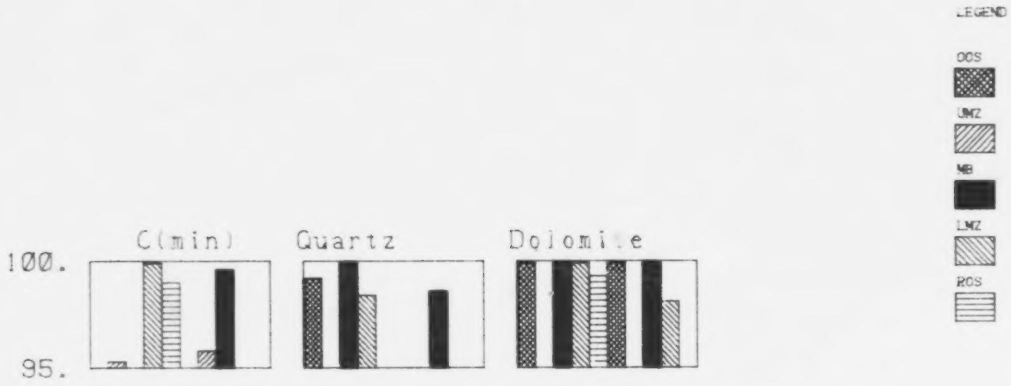
XBL 8010-7330

Figure 34. Statistical significance values for fluorine. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.



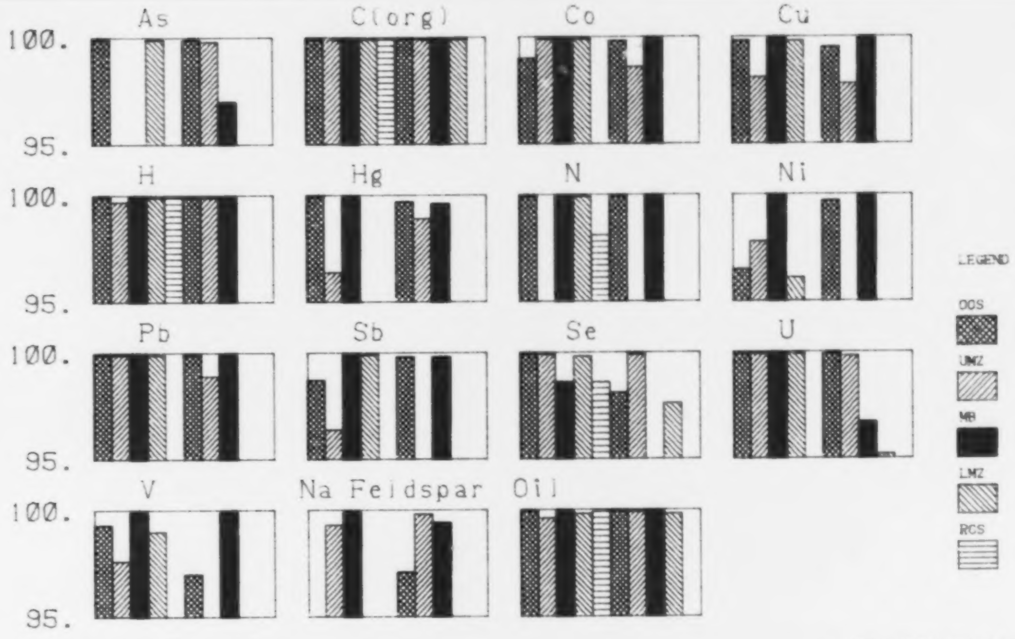
XBL 8010-7333

Figure 35. Statistical significance values for mercury. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.



XBL 8010-7328

Figure 36. Statistical significance values for magnesium. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.



XBL 8010-7336

Figure 37. Statistical significance values for molybdenum. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.

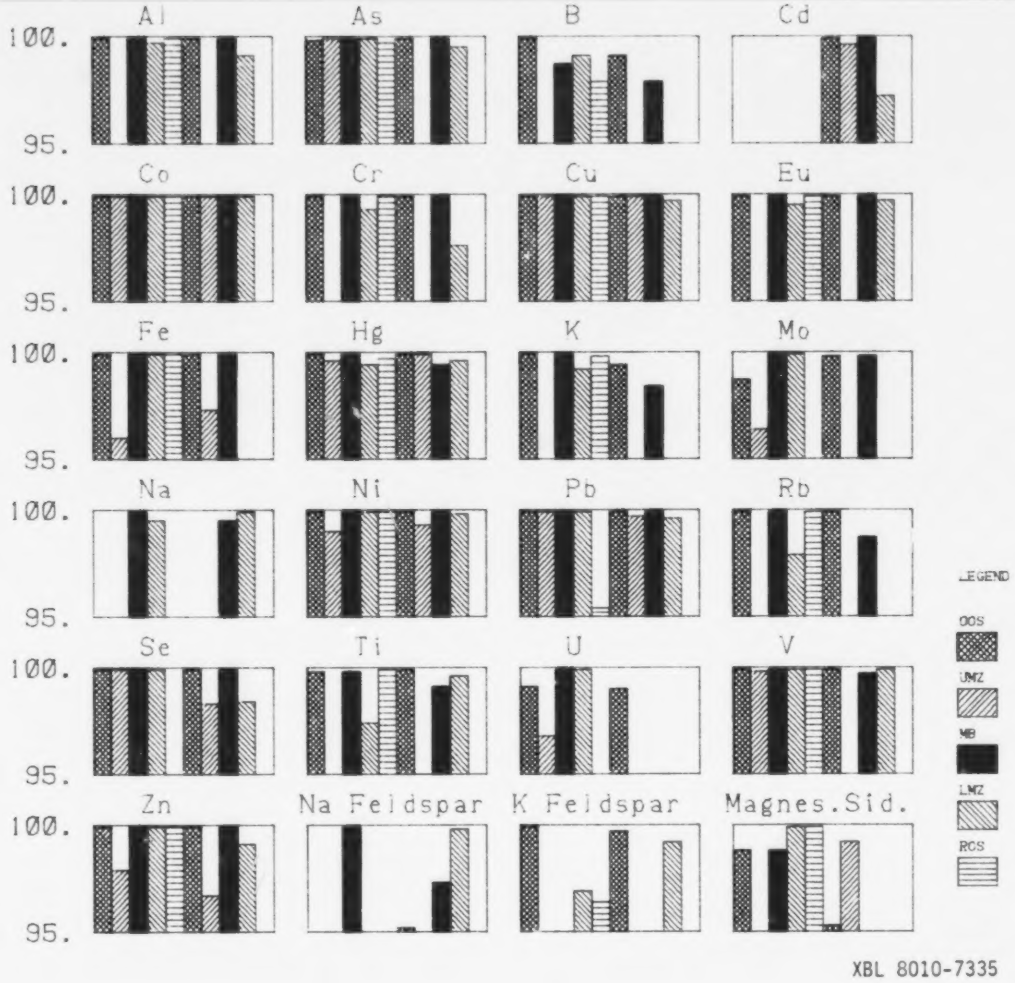
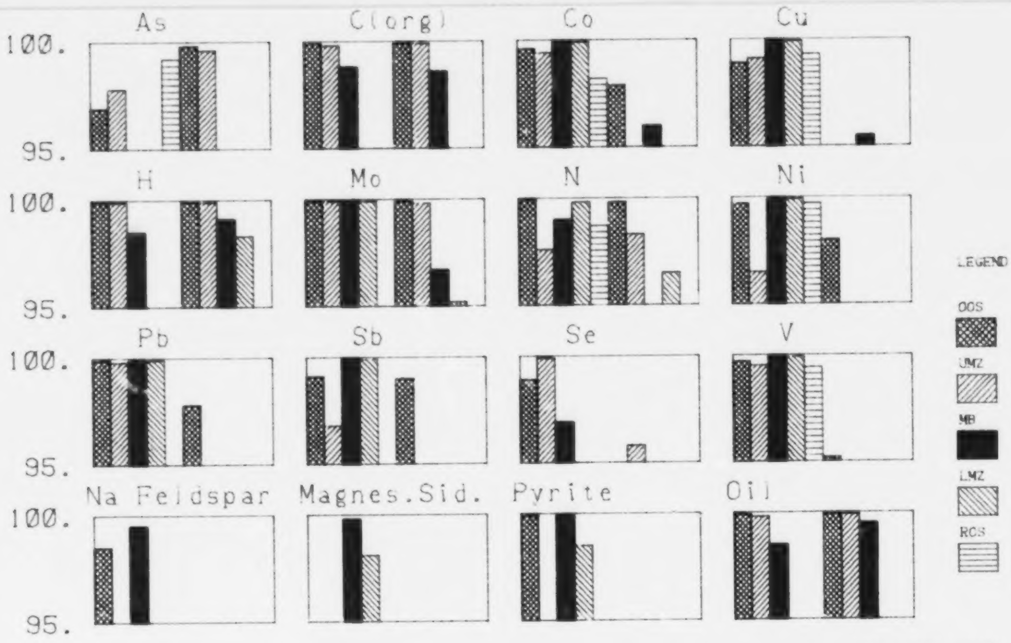


Figure 38. Statistical significance values for antimony. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.



XBL 8010-7332

Figure 39. Statistical significance values for uranium. The first five bars on each graph are for core hole 15/16 and the last four bars are for core hole 25.

Table 1. The principal phases with which the various major, minor, and trace elements are associated.

Al, B, Ce, Co, Cr, Cu, Dy, Eu, Fe, Ga, Hf, La, Mn, Nd, Ni, Pb, Sb, Sc, Sm, Ta, Tb, Th, Ti, V, Y, Yb, Zn, Zr	K-feldspar, Mg-siderite, Na-feldspar
K, Rb	K-feldspar, Mg-siderite
Na	Na-feldspar, Analcime, Water
Cs	Analcime, Water
Ba, C_{min}, Ca, Sr	Calcite
Mg	Dolomite
As, H, Hg, Mo, N, Se, U	C_{org}, Oil
Cd, F	Unknown

Table 2. Chemical composition of the mineral and organic fractions of Green River oil shale.

MINERAL COMPOSITION[a]

Mineral	Chemical Formula	Weight percent of total minerals
Dolomite	$CaMg(CO_3)_2$	32
Calcite	$CaCO_3$	16
Quartz	SiO_2	15
Illite	(silica clay)	19
Na-feldspar	$NaAlSi_3O_8$	10
K-feldspar	$KAlSi_3O_8$	6
Pyrite	FeS_2	1
Analcime	$NaAlSi_2O_6.2H_2O$	1
	TOTAL	100

ORGANIC COMPOSITION[b]

Element	Weight percent of total organics
Carbon	80.5
Hydrogen	10.3
Nitrogen	2.4
Sulfur	1.0
Oxygen	5.8
TOTAL	100.0

[a] Stanfield et al. (1951)

[b] Smith (1961)

Table 3. Stratigraphy and mineralogy of the Green River Formation, Piceance Creek Basin, Colorado.

Geologic Unit	Unit Subdivisions		Lithologic Description	Major Minerals	Minor Minerals	Trace Minerals
Valley Alluvium 0' - 140'	-		Sand, gravel, clay	Quartz Dolomite	Analcime Calcite Albite K-feldspar	Illite Pyrite Siderite Aragonite
Uinta Formation 0' - 1250'	-		Mainly sandstone and siltstone with minor amounts of low-grade oil shale and barren marlstone			
Green River Formation	Parachute Creek Member 500' - 1600'	Upper Part of Parachute Creek Member				
		Mahogany Zone	Moderate- to high-grade oil shale	Dolomite Quartz	Albite Calcite	K-feldspar Aragonite Siderite Illite Pyrite Analcime Dawsonite
		Leached Zone	Low- to high-grade oil shale	Dolomite Albite Quartz Illite	K-feldspar Calcite	Pyrite Siderite Analcime Dawsonite
		Main Saline Zone	Saline minerals and moderate- to high-grade oil shale	Nahcolite Dolomite Quartz	Halite Dawsonite Albite K-feldspar	Pyrite Calcite Siderite Illite
		R-4 Zone				
		Saline Zone				
	Garden Gulch member 0' - 900'		Mainly clayey shale and low- to moderate-grade oil shale	Quartz Dolomite	Albite Illite	Pyrite Calcite K-feldspar Siderite Analcime
	Douglas Creek member 0' - 800'		Mainly sandstone with minor amounts of limestone			
	Anvil Points member 0' - 1670'		Shale, sandstone, marlstone			
Wasatch Formation						

Source: Modified from National Academy of Sciences (1978).

Table 4. The elemental composition of raw oil shales.[a]

	Poulson et al. (1977)		Desborough et al. (1976)		Fruchter et al. (1978,1979)	Wildeman & Meglen (1978)	Shendrikar & Faudel (1978)
	Mahogany Zone in Colorado and Utah	Saline zone in Colorado	Mahogany Bed in Colorado and Utah	R-4 in Colorado	Mahogany Zone at Anvil Points, Colorado	Mahogany Zone at Colony mine, Colorado	Mahogany Zone at Colony mine, Colorado
Ag	<0.02-1.7	0.12-0.45	-	-	-	-	-
Al	-	-	2.2%-3.8%	3.8%-5.3%	3.69% - 3.93%	-	-
As	18-86	2.6 - 3.1	30-75	30-55	43 - 108	64	60 - 65
B	42-230	12-120	60-120	30-300	80 - 111	126	61 - 97.8
Ba	610-750	61-750	300-1200	200-300	320 - 570	-	-
Be	0.26-5.6	<0.18-2.2	-	-	-	-	0.75-1.0
Bi	<0.10-3.5	<0.52-6.1	-	-	-	-	-
Br	0.29-28	6.0-23	-	-	<0.9	-	-
Ca	-	-	3.8%-10%	2.3%-5.4%	10.1 - 11.2	-	-
Cd	0.02-1.4	0.10-0.67	0.7-1.2	0.6 - 1.1	-	-	1.25-1.4
Ce	60-210	4.0-80	-	-	31 - 30	-	-
Cl	60-340	2.8 - >10,000	-	-	-	-	-
Co	7.0 - 12	0.78-21	7-20	7-15	7.8 - 11	-	5.2 - 6.5
Cr	190-1000	43-210	20-60	40-70	21 - 37	-	41.7 - 45.5
Cs	0.06-8.5	0.43-11	-	-	5.2 - 5.5	-	-
Cu	27-120	17-78	42-114	33-72	38 - 72	44	40 - 47.5
Dy	1.7 - 3.9	<0.27-3.1	-	-	-	-	-
Er	0.28-1.4	<0.08-0.28	-	-	1.0	-	-
Eu	0.56-2.0	<0.18-1.8	-	-	0.43-0.69	-	-
F	120-3700	360-1200	900-1500	700-1900	-	1070	915 - 1162
Fe	-	-	1.3%-2.0%	2.0%-2.7%	1.74%-2.28%	-	-
Ga	4.0 - 16	1.1-18	5-10	10	4.1 - 5	-	-
Gd	0.43-18	<0.06-0.71	-	-	1.9	-	-
Ge	0.91-2.9	0.37-1.9	-	-	-	-	-
Hf	<1.0 - 4.0	<0.55-2.5	-	-	0.71-1.9	-	-
Hg	0.31-2.1	-	0.08-2.9	0.09-0.19	0.08-0.2	-	-
Ho	0.16-0.37	0.05-0.44	-	-	0.33	-	-
I	0.13-450	0.06-13	-	-	-	-	-
K	-	-	0.7%-1.0%	1.1%-2.2%	1.50%-1.70%	-	-
La	17-50	1.1 - 37	40-45	40-50	15.9-20.3	-	-
Li	1.9 - 160	5.7 - 100	37-208	35-95	-	-	-
Lu	<0.06-0.38	0.17-0.50	-	-	0.14-0.34	-	-
Mg	-	-	1.7%-4.8%	0.60%-1.6%	3.46%-3.75%	-	-
Mn	160-390	9.0 - 320	181-268	196-296	290 - 330	196	201 - 230
Mo	10-37	8.7 - 87	15-40	7-40	21 - 23	28	30.0 - 37.0
Na	-	-	0.7%-1.8%	0.7%-1.9%	1.62% - 1.77	-	-
Nb	3.9 - 14	1.4 - 20	-	-	-	-	-
Nd	19-77	2.4 - 29	-	-	15	-	-
Ni	130-760	28-110	20-40	20-40	23 - 33	24	22.4 - 23.9
P	170-4200	510-4200	220-3500	870-3500	-	-	-
Pb	1.0 - 70	1.4 - 70	30-52	19-32	21 - 27	27	27.6 - 30.3
Pr	6.6 - 20	0.60-16	-	-	3.9	-	-
Rb	67-450	11-110	-	-	63-75	60	-
S	0.12%-0.49%	480 - >10,000	0.2%-1.75%	1.36%-2.4%	0.60%	-	-
Sb	0.18-5.2	0.21-11	1.5 - 6	1.0-2.9	2.0 - 3.6	-	-
Sc	2.7 - 69	0.12-4.4	5-10	5-10	4.9 - 6.9	-	-
Se	1.3 - 5.2	0.78-4.7	1-3	<0.1-3	<0.6 - 6	2.9	10.0 - 14.6
Si	-	-	12%-14%	13%-19%	14.5%-15.5%	-	-
Sm	0.93-9.0	<0.50-5.1	-	-	2.4 - 3.5	-	-
Sn	1.2 - 4.6	0.35-2.2	-	-	-	-	-
Sr	400 - 2700	59-1400	212-688	49-260	440 - 740	580	-
Ta	0.38-1.9	0.43-4.8	-	-	0.53 - 0.44	-	-
Tb	0.2 - 0.87	<0.13-1.1	-	-	0.26	-	-
Te	<0.31-0.35	0.11	-	-	-	-	-
Th	1.2 - 12	1.6 - 13	5.06-10.8	7.81-13.7	4.3-6.8	-	-
Ti	0.12%-0.41%	150-1600	700-2000	1000-2000	0.17%-0.20%	-	-
Tl	<0.59-0.80	<0.12-1.4	-	-	-	-	-
Tm	<0.07-0.19	<0.03-0.09	-	-	0.14	-	-
U	1.6 - 7.0	0.30-7.8	4.75-6.78	4.21-8.10	3.0-7.0	5.4	-
V	73-280	10-110	100-200	100-150	65-94	-	43.5 - 57.1
W	<0.03-2.1	<0.32-2.9	-	-	-	-	-
Y	11-50	1.8 - 29	10	10	-	7.7	-
Yb	<0.24-2.5	<0.49-1.6	-	-	0.87 - 0.8	-	-
Zn	4.3-120	12-60	49-111	81-112	30-136	70	62.5 - 65.0
Zr	12-60	3.0-60	20-70	40-70	-	-	-

[a] All concentration values are in μg/g unless otherwise indicated.

Table 5. List of elements and analytical techniques applied for the determinations.

ELEMENTS DETERMINED	ANALYTICAL TECHNIQUE
Ag, Al, As, Au, Ba, Ca, Ce, Cl, Co, Cr, Cs, Dy, Eu, Fe, Hf, In, Ir, K, La, Lu, Mg, Mn, Mo, Na, Nd, Sb, Sc, Sm, Sn, Ta, Tb, Th, Ti, U, V, W, Yb	Instrumental Neutron Activation
Br, Cu, Ga, Ge, Ni, Pb, Rb, Se, Sr, Y, Zn, Zr	X-ray Fluorescence
Cd, Hg	Zeeman Atomic Absorption
C_{org}, H, N	Combustion
C_{min}	Gravimetric
B	Optical Emission
F	Spectrophotometric

Table 6. Minerals determined for composited sample intervals.

Carbonate Minerals	
Dolomite	$CaCO_3 \cdot (MgFe)CO_3$
Calcite	$CaCO_3$ (Hexagonal)
Aragonite	$CaCO_3$ (Orthorhombic)
Mg-siderite	$(Mg_{1-x}, Fe_x)CO_3$
Dawsonite	$NaAl(OH)_2CO_3$
Silicate Minerals	
K-feldspar	$K_2O \cdot Al_2O_3 \cdot 6SiO_2$
Na-feldspar	$Na_2O \cdot Al_2O_3 \cdot 6SiO_2$
Analcime	$Na_2O \cdot Al_2O_3 \cdot 4SiO_2 \quad 2.5H_2O$
Illite	$KAl_2(AlSi_3)O_{10}(OH)_2$
Quartz	SiO_2
Other Minerals	
Pyrite	FeS_2
Fluorite	CaF_2

Table 7. Core Stratigraphy and Compositing Plan

Depth in Feet	Stratigraphy/ Technology	Feet of Core	Composite Interval in Feet	Number of Samples for Analysis
Core Hole No. 15/16				
856-1208	Overlying oil shale; vertical modified in-situ retorting	352	5	70
1208-1244	Upper Mahogany Zone; vertical modified in-situ retorting, mining	36	2	18
1244-1270	Mahogany Bed; mining with surface retorting	26	1	26
1270-1346	Lower Mahogany Zone; vertical modified in-situ retorting, mining	76	2	36
1346-1372	B-groove	26	26	1
1372-1468	Rich oil shale; vertical modified in-situ retorting	96	5	17
1468-2019	Poor oil shale; commercial development not anticipated	551	50	11
	TOTALS	1163		179

Table 7. Core Stratigraphy and Compositing Plan (continued)

Depth in Feet	Stratigraphy/ Technology	Feet of Core	Composite Interval in Feet	Number of Samples for Analysis
Core Hole No. 25				
130-388	Solution cavity zone; commercial development not anticipated	258	50	5
388-634	Overlying oil shale; vertical modified in-situ retorting	246	5	49
634-670	Upper Mahogany Zone; vertical modified in-situ retorting, mining	36	2	18
670-690	Mahogany Bed; mining with surface retorting	20	1	20
690-705	Lower Mahogany Zone; vertical modified in-situ retorting, mining	15	2	7
705-790	Poor oil shales; commercial development not anticipated	86	42	2
	TOTALS	660		101

Table 8. Elemental abundances in pulverized oil shale sample used in the homogeneity experiment.[a]

	JAR NO. 1				JAR NO. 2		JAR NO. 3		JAR NO. 4		
	Replicate 1	Replicate 2	Replicate 3	Replicate 4	Replicate 1	Replicate 2	Replicate 1	Replicate 2	Replicate 1	Replicate 2	
Al%	7.00 ± 0.21	6.75 ± 0.10	6.97 ± 0.11	7.03 ± 0.15	7.00 ± 0.18	6.59 ± 0.23	6.82 ± 0.08	6.82 ± 0.09	7.23 ± 0.11	7.06 ± 0.14	Al%
As	13.1 ± 2.4	19.9 ± 2.5	20.7 ± 2.5	11.4 ± 2.5	16.6 ± 2.5	15.6 ± 2.5	20.5 ± 2.5	17.0 ± 2.5	18.4 ± 2.5	12.5 ± 2.5	As
Ba	897 ± 17	937 ± 17	910 ± 17	898 ± 17.0	885 ± 16	837 ± 16	919 ± 17	943 ± 18	965 ± 18	959 ± 18	Ba
Ca%	5.75 ± 0.70	4.89 ± 0.49	4.97 ± 0.46	4.83 ± 0.59	4.60 ± 0.64	5.75 ± 0.72	4.89 ± 0.49	5.37 ± 0.51	6.68 ± 0.55	5.27 ± 0.61	Ca%
Ce	69.8 ± 0.9	67.8 ± 0.9	67.8 ± 0.9	69.1 ± 0.9	65.8 ± 0.9	69.0 ± 0.9	68.0 ± 0.7	64.6 ± 0.8	70.5 ± 0.9	68.1 ± 0.9	Ce
Co	12.0 ± 0.2	12.1 ± 0.2	11.9 ± 0.2	12.2 ± 0.2	11.6 ± 0.2	12.1 ± 0.2	12.2 ± 0.2	12.2 ± 0.2	12.2 ± 0.2	12.2 ± 0.2	Co
Cr	73.4 ± 3.8	81.5 ± 3.9	77.8 ± 3.8	81.5 ± 3.9	70.6 ± 3.7	76.2 ± 3.8	67.5 ± 3.6	74.2 ± 3.6	74.7 ± 3.6	71.5 ± 3.6	Cr
Cs	5.82 ± 0.16	6.02 ± 0.17	5.59 ± 0.16	6.08 ± 0.17	5.95 ± 0.17	5.95 ± 0.17	5.91 ± 0.17	5.93 ± 0.17	5.79 ± 0.17	5.97 ± 0.17	Cs
Dy	2.83 ± 0.10	2.66 ± 0.09	2.84 ± 0.05	2.95 ± 0.11	2.88 ± 0.11	2.64 ± 0.11	2.70 ± 0.09	2.72 ± 0.09	2.78 ± 0.05	2.69 ± 0.10	Dy
Eu	1.04 ± 0.01	1.04 ± 0.01	1.05 ± 0.01	1.05 ± 0.01	1.04 ± 0.01	1.05 ± 0.01	1.03 ± 0.01	1.01 ± 0.01	1.02 ± 0.01	1.03 ± 0.01	Eu
Fe%	3.00 ± 0.04	3.00 ± 0.04	3.02 ± 0.04	3.01 ± 0.04	2.96 ± 0.04	2.98 ± 0.04	3.07 ± 0.04	2.99 ± 0.04	2.97 ± 0.04	2.99 ± 0.04	Fe%
Hf	3.80 ± 0.07	3.72 ± 0.07	4.07 ± 0.07	3.91 ± 0.07	3.84 ± 0.07	4.03 ± 0.07	3.88 ± 0.07	3.56 ± 0.07	3.62 ± 0.07	3.66 ± 0.07	Hf
K%	2.46 ± 0.23	2.43 ± 0.23	2.21 ± 0.12	2.48 ± 0.23	2.36 ± 0.22	2.21 ± 0.22	2.25 ± 0.22	2.00 ± 0.22	1.86 ± 0.11	2.20 ± 0.22	K%
La	36.5 ± 0.9	34.3 ± 0.9	35.0 ± 0.9	34.6 ± 0.9	35.1 ± 0.9	35.8 ± 0.9	36.0 ± 1.0	34.3 ± 1.0	37.3 ± 1.0	37.2 ± 1.0	La
Lu	0.239 ± 0.015	0.253 ± 0.015	0.246 ± 0.015	0.226 ± 0.015	0.237 ± 0.015	0.247 ± 0.015	0.253 ± 0.015	0.226 ± 0.015	0.221 ± 0.015	0.241 ± 0.015	Lu
Mg%	1.74 ± 0.67	1.93 ± 0.59	1.88 ± 0.51	2.26 ± 0.61	1.08 ± 0.65	3.25 ± 0.68	2.19 ± 0.61	1.69 ± 0.60	2.76 ± 0.59	1.12 ± 0.63	Mg%
Mn	418 ± 3	411 ± 3	410 ± 3	415 ± 3	415 ± 3	414 ± 3	409 ± 3	398 ± 3	413 ± 3	412 ± 3	Mn
Mo	4.81 ± 0.68	6.47 ± 0.73	4.93 ± 0.70	5.79 ± 0.72	5.10 ± 0.70	5.56 ± 0.71	4.47 ± 0.70	5.63 ± 0.72	4.57 ± 0.70	4.85 ± 0.71	Mo
Na%	3.34 ± 0.02	3.22 ± 0.02	3.24 ± 0.02	3.26 ± 0.02	3.24 ± 0.02	3.26 ± 0.02	3.26 ± 0.02	3.24 ± 0.02	3.29 ± 0.02	3.29 ± 0.02	Na%
Nd	27.8 ± 1.2	28.7 ± 1.2	26.6 ± 1.2	28.9 ± 1.2	30.7 ± 1.2	28.4 ± 1.2	26.2 ± 1.2	27.7 ± 1.2	29.2 ± 1.2	27.3 ± 1.2	Nd
Sb	0.78 ± 0.09	0.72 ± 0.09	0.89 ± 0.09	0.83 ± 0.09	0.89 ± 0.09	0.83 ± 0.09	0.92 ± 0.10	0.87 ± 0.10	0.86 ± 0.10	0.71 ± 0.09	Sb
Sc	9.52 ± 0.04	9.54 ± 0.04	9.58 ± .04	9.63 ± 0.04	9.57 ± 0.04	9.63 ± 0.04	9.53 ± 0.04	9.51 ± 0.04	9.50 ± 0.04	9.54 ± 0.04	Sc
Sm	4.34 ± 0.02	4.27 ± 0.02	4.32 ± 0.02	4.35 ± 0.02	4.30 ± 0.02	4.39 ± 0.02	4.29 ± 0.02	4.26 ± 0.02	4.40 ± 0.02	4.29 ± 0.02	Sm
Ta	0.686 ± 0.005	0.678 ± 0.005	0.690 ± 0.005	0.676 ± 0.005	0.683 ± 0.005	0.695 ± 0.005	0.673 ± 0.005	0.670 ± 0.005	0.669 ± 0.005	0.704 ± 0.005	Ta
Tb	0.491 ± 0.026	0.454 ± 0.025	0.449 ± 0.025	0.489 ± 0.026	0.501 ± 0.026	0.499 ± 0.026	0.492 ± 0.026	0.493 ± 0.026	0.473 ± 0.026	0.458 ± 0.025	Tb
Th	10.6 ± 0.1	10.6 ± 0.1	10.8 ± 0.1	10.7 ± 0.1	10.4 ± 0.1	10.6 ± 0.1	10.5 ± 0.1	10.3 ± 0.1	10.7 ± 0.1	10.5 ± 0.1	Th
Ti%	0.241 ± 0.029	0.265 ± 0.021	0.279 ± 0.019	0.269 ± 0.024	0.295 ± 0.027	0.245 ± 0.030	0.264 ± 0.021	0.252 ± 0.021	0.192 ± 0.023	0.273 ± 0.025	Ti%
U	3.57 ± 0.04	3.64 ± 0.04	3.58 ± 0.04	3.72 ± 0.04	3.58 ± 0.04	3.62 ± 0.04	3.55 ± 0.04	3.56 ± 0.04	3.53 ± 0.04	3.52 ± 0.04	U
V	148 ± 25	120 ± 15	105 ± 14	113 ± 18	92 ± 20	78 ± 23	104 ± 13	102 ± 14	122 ± 16	105 ± 17	V
W	0.92 ± 0.78	2.16 ± 0.7%	2.14 ± 0.80	1.08 ± 0.82	2.51 ± 0.79	1.83 ± 0.80	2.88 ± 0.90	1.40 ± 0.90	3.63 ± 0.91	1.74 ± 0.93	W
Yb	1.69 ± 0.03	1.68 ± 0.03	1.72 ± 0.03	1.69 ± 0.03	1.64 ± 0.03	1.71 ± 0.03	1.62 ± 0.03	1.64 ± 0.03	1.56 ± 0.03	1.64 ± 0.03	Yb

[a] All abundances are reported in µg/g unless otherwise indicated.

Table 9. Elemental abundances of obsidian used in contamination experiments.[a]

	Obsidian Composition (Bowman et al., 1973)	After pulverizing to 100 to 200 mesh in:		
		New Jar	Used Jar	Agate Mortar
Al%	6.4 ± 0.2	6.88 ± 0.10	7.20 ± 0.16	6.81 ± 0.17
As	---	13.0 ± 2.0	13.0 ± 2.0	13.4 ± 2.1
Ba	432 ± 14	411.0 ± 12.0	410.0 ± 12.0	427.0 ± 12.0
Ca%	< 2	< 0.9	< 1.5	< 1.9
Ce	67.4 ± 2.2	67.1 ± 0.8	66.2 ± 0.8	65.6 ± 0.8
Co	---	0.17 ± 0.05	0.19 ± 0.05	0.19 ± 0.05
Cr	---	< 4.0	< 5.2	< 3.8
Cs	15.3 ± 0.3	15.8 ± 0.3	15.6 ± 0.3	16.0 ± 0.3
Dy	7.63 ± 0.21	7.17 ± 0.09	7.16 ± 0.09	6.97 ± 0.06
Eu	0.27 ± 0.03	0.267 ± 0.007	0.264 ± 0.007	0.272 ± 0.007
Fe%	0.92 ± 0.02	0.93 ± 0.02	0.91 ± 0.02	0.92 ± 0.02
Hf	7.57 ± 0.25	7.72 ± 0.09	7.69 ± 0.09	7.50 ± 0.09
K%	4.3 ± 0.5	3.90 ± 0.22	3.73 ± 0.22	3.74 ± 0.13
La	31.3 ± 0.6	31.9 ± 0.8	32.4 ± 0.8	31.6 ± 0.9
Lu	0.622 ± 0.15	0.670 ± 0.020	0.672 ± 0.020	0.682 ± 0.020
Mg%	---	< 1.1	< 1.6	< 1.2
Mn	149 ± 3	146 ± 3	147 ± 3	145 ± 3
Mo	---	1.13 ± 0.74	2.35 ± 0.75	1.50 ± 0.74
Na%	3.37 ± 0.04	3.30 ± 0.02	3.35 ± 0.02	3.30 ± 0.02
Nd	---	31.2 ± 1.1	31.9 ± 1.2	29.7 ± 1.1
Sb	1.23 ± 0.15	1.16 ± 0.09	1.28 ± 0.10	1.36 ± 0.11
Sc	2.86 ± 0.04	2.89 ± 0.02	2.86 ± 0.02	2.83 ± 0.02
Sm	5.93 ± 0.05	5.96 ± 0.02	5.93 ± 0.02	5.90 ± 0.02
Ta	.93 ± 0.06	0.931 ± 0.005	0.917 ± 0.005	0.902 ± 0.006
Tb	.97 ± 0.05	1.04 ± 0.03	1.04 ± 0.03	1.03 ± 0.04
Th	17.93 ± 0.13	18.7 ± 0.08	18.4 ± 0.08	18.6 ± 0.08
Ti%	0.05 ± 0.05	0.068 ± 0.017	0.053 ± 0.022	0.036 ± 0.024
U	6.85 ± 0.06	6.97 ± 0.05	6.82 ± 0.05	6.75 ± 0.05
V	--- ---	< 26	24 ± 18	24 ± 16
W	---	3.28 ± 0.76	2.19 ± 0.78	3.73 ± 0.95
Yb	4.79 ± 0.23	5.04 ± 0.05	4.92 ± 0.05	4.78 ± 0.05

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[a] All abundances are reported in μg/g unless otherwise indicated.

Table 10. Neutron irradiation and counting schedules used by LBL.

	Irradiation time	Neutron flux (n/cm^2-sec)	Cooling time	Counting time (min)	Elements detected
LBL	18 min	2×10^{11}	8 min	1	Al, Ca, V, Cl, Mg, Ti
			1.25 hrs	6	Mn, Na, K, Eu, Ba, Sr, Cu In, Ga, Dy
	8 hrs	2×10^{13}	6 days	20	U, Sm, Lu, Ti, La, As, Br Cd, Mo, W, Ba, Au, Nd
			30 days	60,90	Fe, Sc, Ta, Eu, Zn, Co, Cs Sb, Ce, Ir, Se, Ag, Hf, Th Ni, Rb, Yb, Cr, Tb, Sn, Nd

Table 11. Range of Fischer Assay and mineral results for the two core holes.

	Core Hole 15/16 Conc. Range (%)	Core Hole 25 Conc. Range (%)
Oil	1-29	1-24
Water	0.3-2.4	0.8-3.0
Analcime	0-14	0-14
Quartz	3-16	7-15
Calcite	0-13	0-18
Dolomite	15-47	21-47
	XRD PEAK HT.	XRD PEAK HT.
Na-feldspar	8-110	8-106
K-feldspar	8-62	9-59

Table 12. Element concentration ranges for the two core holes.[a]

	Core Hole 15/16	Core Hole 25		Core Hole 15/16	Core Hole 25
Ag	<0.7-1.7	<1.0-1.4	La	10-34	12-32
Al(%)	1.8-6.9	2.0-6.5	Lu	0.08-0.34	0.11-0.36
As	5-134	8-98	Mg(%)	1.8-5.8	1.9-5.9
Au	<0.02-0.4	<0.03-0.14	Mn	190-460	201-440
B	25-250	40-200	Mo	4-54	7-48
Ba	240-1230	270-800	N(%)	0.2-1.2	0.2-1.1
Br	<0.6-1.4	<0.6-0.8	Na(%)	0.4-3.1	0.4-3.1
C_{min}(%)	1.9-7.2	2.1-7.2	Nd	8-30	9-25
C_{org}(%)	3-35	2-29	Ni	11-32	11-30
Ca(%)	5-21	5-19	Pb	8-41	9-39
Cd	b	0.2-1.4	Rb	32-124	47-139
Ce	21-69	25-63	Sb	0.5-5.2	0.8-3.9
Cl(%)	0.05-0.12	0.05-0.09	Sc	3-12	4-10
Co	5-14	4-13	Se	0.5-12.3	0.5-3.7
Cr	18-60	17-54	Sm	1.5-5.0	1.7-5.3
Cs	0.7-14.	2.0-5.9	Sn	<80-130	<80-130
Cu	11-63	14-58	Sr	260-1440	300-1120
Dy	1.1-3.9	1.3-4.9	Ta	0.24-0.74	0.27-0.77
Eu	0.3-1.1	0.4-1.0	Tb	0.15-0.58	0.20-0.73
F	200-3200	100-2500	Th	3.1-10.6	3.8-9.2
Fe(%)	1.0-3.5	1.1-3.2	Ti(%)	0.03-0.28	0.06-0.27
Ga	3-17	5-16	U	1.8-8.2	2.0-6.1
Ge	<1.1-2.3	<1.1-2.0	V	29-203	45-185
H(%)	0.3-4.5	0.4-3.8	W	<0.8-11.	<0.9-3.0
Hg	0.01-0.50	0.03-0.21	Y	2-23	4-28
Hf	0.8-2.7	1.1-3.5	Yb	0.6-2.5	0.8-2.6
In	<0.1-0.6	<0.1-0.3	Zn	38-153	41-111
Ir	<0.004-0.008	<0.005-0.009	Zr	13-73	18-219
K(%)	0.6-5.6	0.8-5.7			

[a] All concentration ranges are in µg/g unless otherwise indicated.

[b] Concentration range not determined.

Table 13a. Statistical significance values for 48 elements paired with 29 elements.

Core	Hole	H		N		C_{org}		C_{min}		Na		Mg		Al		K		Ca		Fe	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Al	1			99.8	98.3											99.9	99.9			99.9	99.9
	2			95.4												99.9	99.9			99.9	99.9
	3	99.8		99.7	97.3	99.9				99.9	99.9					99.9	99.5			99.9	99.9
	4									99.9	98.9					99.9	99.8			99.9	98.5
	5															99.9				99.9	
As	1	99.9	99.9	97.6	99.9	99.9	99.9														
	2	95.1	99.8	99.2	96.6		99.7													95.2	
	3		95.4		95.2		97.5				99.9				99.9						99.8
	4	99.9	98.3	99.9	98.4	99.9	97.3				98.0										
	5													98.7						95.9	
B	1			99.9	99.6								96.7	99.9	99.9	99.9	99.9			99.9	99.9
	2													96.0	99.9	99.8	99.9				99.9
	3	99.7	99.9	99.9	99.9	99.8	99.9			98.3				99.9	95.0	99.9	99.9			99.9	99.6
	4	98.5		98.6		95.7											98.8				
	5													96.0							
Ba	1																	98.7			
	2						95.2		99.9		95.9		97.0						99.2		
	3							99.9	99.7									99.9	99.9		
	4								97.7									98.8	99.8		
	5							99.7										99.9			
C_{min}	1																	99.9	99.9		
	2						95.7					95.3	95.8					99.5	99.9		
	3												99.6					99.9	99.9		
	4											99.9						99.9	99.9		
	5											99.0						99.9			
C_{org}	1	99.9	99.9	99.9	99.9													95.7			
	2	99.9	99.9		96.3				95.7		99.9								99.9		
	3	99.9	99.9	99.9	99.9					99.9				99.9		99.9	98.6			99.9	99.3
	4	99.9		99.9																	
	5	99.9		99.9																	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13a. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	H		N		C_{org}		C_{min}		Na		Mg		Al		K		Ca		Fe	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Ca	1					95.7		99.9	99.9												
	2		99.7				99.9	99.5	99.9												
	3							99.9	99.9												
	4							99.9	99.9												
	5							99.9													
Cd	1				99.9										99.9		99.9				99.5
	2																				
	3		95.8		98.2		97.1				99.7				99.9						99.6
	4						96.2								95.9						98.8
	5																				
Ce	1			99.7	98.7									99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.9			99.9	99.9
	3					96.5				99.9	99.9			99.9	99.9	99.9	95.9			99.9	99.9
	4									99.9	99.6			99.9	99.9	99.9	99.6			99.9	96.8
	5													99.9		99.0				99.9	
Co	1	97.6	98.5	99.9	99.9		97.3							99.9	99.9	99.9	99.8			99.9	99.9
	2			95.5																98.6	97.8
	3	99.9	99.9	99.9	99.9	99.9	99.9			99.9	98.5			99.9	99.9	99.9	99.7			99.9	99.9
	4		96.3	99.9	98.1					99.3	98.8			99.9	99.4	99.9				99.9	97.2
	5													99.7		98.2				99.9	
Cr	1				99.0									99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.9			99.9	99.9
	3	99.9	98.9	99.6	99.0	99.9	99.1			99.9	99.5			99.9	99.9	99.9	97.0			99.9	99.9
	4									99.9	96.6			99.9	99.4	99.9	98.9			99.9	95.3
	5													99.9		99.9				99.9	
Cs	1		95.8							99.9	99.9				99.9						99.9
	2																				
	3	99.9		99.9		99.9				99.9	99.9			99.9	99.8	99.9				99.9	98.3
	4						99.7			98.0				99.0						97.7	
	5													97.3							

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13a. Statistical significance values for 48 elements paired with 29 elements (Continued).

		H		N		C_{org}		C_{min}		Na		Mg		Al		K		Ca		Fe	
Core	Hole	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Cu	1	97.9		99.9	99.9	96.1								99.9	99.9	99.9	99.9			99.9	99.9
	2			98.4																99.1	
	3	99.9	99.9	99.9	99.9	99.9	99.9			99.9	99.0			99.9	99.9	99.9	99.7			99.9	99.9
	4			99.6	96.1					99.5	97.8			99.9	98.8	99.9				99.9	98.2
	5													99.8		98.1				99.9	
Dy	1				99.4									99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.4			99.9	99.0
	3									99.9	99.8			99.9	99.9	99.9				99.9	99.7
	4									99.9	99.1			99.9	99.9	99.9	99.6			99.9	97.9
	5													99.9		99.9				99.9	
Eu	1			98.1	99.8									99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.9			99.9	99.9
	3									99.9	99.9			99.9	99.9	99.9				99.9	99.9
	4				95.2					99.9	99.7			99.9	99.9	99.9	99.5			99.9	96.8
	5													99.9		99.9				99.9	
F	1	97.3				96.8															
	2												99.6								
	3	98.4		96.4		98.6				99.7			95.2	99.9		99.9				99.9	
	4																				
	5																				
Fe	1			99.9	99.7									99.9	99.9	99.9	99.9				
	2			97.6										99.9	99.9	99.9	99.9				
	3	99.9	99.5	99.8	99.7	99.9	99.3			99.9	98.6			99.9	99.9	99.9	99.9				
	4									99.9				99.9	98.5	99.9	97.4				
	5													99.9		99.9					
Ga	1			97.1	99.6									99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.9			99.9	99.9
	3	95.5				97.2				99.9	99.7			99.9	99.9	99.9	98.5			99.9	99.9
	4									99.9	98.1			99.9	99.9	99.9	99.7			99.9	
	5													99.9		99.9				99.9	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13a. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	H		N		C_{org}		C_{min}		Na		Mg		Al		K		Ca		Fe	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
H	1			99.9	96.7	99.9	99.9														
	2				97.6	99.9	99.9				99.9								99.7		
	3			99.9	99.9	99.9	99.9			99.9				99.8		99.9	98.9			99.9	99.5
	4			99.9	99.9	99.9					98.4										
	5			99.9		99.9															
Hf	1			99.7							99.8			99.9	99.9	99.9	98.8			99.9	99.9
	2														99.9		99.4				99.6
	3	98.1		98.0		98.9				99.9	97.6			99.9	99.9	99.9				99.9	99.6
	4									99.9				99.9		99.9				99.9	
	5													99.9		97.5				99.9	
Hg	1	99.9	97.2	99.9	99.9	99.9	99.8													98.2	
	2	98.5		98.1		97.9															
	3	97.2	99.9	97.5	99.9	97.9	99.9			99.5	96.2			99.9		99.9				99.9	98.9
	4										99.1				98.4		96.6				
	5													99.3						98.2	
K	1			99.9	99.9								95.9	99.9	99.9					99.9	99.9
	2			98.4										99.9	99.9					99.9	99.9
	3	99.9	98.9	99.8	99.9	99.9	98.6			99.9				99.9	99.5					99.9	99.9
	4									99.9				99.9	99.8					99.9	97.4
	5													99.9						99.9	
La	1			99.9	99.0									99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.9			99.9	99.9
	3	96.5				97.8				99.9	99.9			99.9	99.9	99.9	98.3			99.9	99.9
	4				95.0					99.9	99.8			99.9	99.9	99.9	99.4			99.9	96.7
	5													99.9		98.4				99.9	
Mg	1																95.9				
	2							95.3	95.8												
	3								99.6												
	4							99.9													
	5							99.0													

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13a. Statistical significance values for 48 elements paired with 29 elements (Continued).

		H		N		C_{org}		C_{min}		Na		Mg		Al		K		Ca		Fe	
Core	Hole	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Mn	1														96.1					97.5	98.9
	2													99.9	99.9	99.9	99.9			99.7	99.9
	3							99.9	99.5									99.6	99.7		
	4		96.0		96.9					99.9	99.9			99.9	98.8	99.9				99.9	
	5													99.9		99.9		99.9		99.9	
Mo	1	99.9	99.9	99.9	99.9	99.9	99.9														
	2	99.7	99.9			99.9	99.9			98.7	99.8										
	3	99.9	99.9	99.9	99.9	99.9	99.9			99.9				99.9	98.9	99.9	99.3			99.9	99.9
	4	99.9		99.9		99.9	99.9														
	5	99.9		98.1		99.9		95.1													
N	1	99.9	96.7			99.9								99.8	98.3	99.9	99.9			99.9	99.7
	2		97.6				96.3							95.4		98.4				97.6	
	3	99.9	99.9			99.9	99.9			99.4				99.7	97.3	99.8	99.9			99.8	99.7
	4	99.9	99.9			99.9					98.9										
	5	99.9				99.9															
Na	1																				
	2		99.9				99.9														
	3	99.9		99.4		99.9								99.9	99.9	99.9				99.9	98.6
	4		98.4		98.9									99.9	98.9	99.9				99.9	
	5																				
Nd	1			99.4										99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.9			99.9	99.9
	3									99.9	99.9			99.9	99.9	99.9				99.9	99.9
	4				96.9					99.9	99.3			99.9	99.9	99.9	97.6			99.9	97.6
	5													99.9		98.3				99.9	
Ni	1			99.9	99.9									99.9	99.9	99.9	99.0			99.9	99.9
	2																			95.5	97.6
	3	99.5	99.9	98.9	99.9	99.8	99.9			99.9	98.8			99.9	99.9	99.9	99.8			99.9	99.9
	4			95.8	95.3					99.9	99.7			99.9	99.9	99.9	97.1			99.9	97.2
	5													99.5		96.8				99.9	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13a. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	H		N		C_{org}		C_{min}		Na		Mg		Al		K		Ca		Fe	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Pb	1	98.5	99.4	99.9	99.9		97.7							99.9	99.9	99.9	98.3			99.9	99.9
	2	97.9				98.7															97.2
	3	99.9	99.9	99.9	99.9	99.9	99.9			99.9	98.8			99.9	99.9	99.9	99.7			99.9	99.9
	4			99.3						99.7	98.3			99.9	99.6	99.9	95.1			99.9	99.3
	5																			97.9	
Rb	1			99.9	99.9									99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.9			99.9	99.9
	3	99.7	98.8	99.4	99.8	99.8	98.8			99.9				99.9	99.2	99.9	99.9			99.9	99.2
	4									99.9				99.9	97.9	99.9	95.5			99.9	
	5													99.9		99.9				99.9	
Sb	1		96.3	99.9	99.9		99.0							99.9	99.9	99.9	99.4			99.9	99.9
	2			97.7																96.0	97.3
	3	98.1	97.8		99.2	98.9	98.9			99.9	99.5			99.9	99.9	99.9	98.4			99.9	99.9
	4	97.6	99.0	99.8	99.4	96.8				99.5	99.9			99.7	99.1	99.2				99.9	
	5													99.9		99.8				99.9	
Sc	1			99.8	99.8								98.7	99.9	99.9	99.9	99.9			99.9	99.9
	2			97.8										99.9	99.1	99.9	99.9			99.9	99.7
	3	97.8		97.1	96.4	98.7				99.9	99.9			99.9	99.9	99.9	99.1			99.9	99.9
	4									99.9				99.9		99.9				99.9	99.9
	5													99.9		99.9				99.9	
Se	1	99.9	99.2	99.5	99.5	99.9	99.9											96.9			
	2	99.9	97.0			99.9	96.0				95.6										
	3		95.7		96.5		98.5				97.6				96.2	98.0				96.7	
	4	99.9		99.9		99.9	97.[illegible]														
	5					96.2															
Sm	1			98.6	99.6									99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.8			99.9	99.8
	3									99.9	99.9			99.9	99.9	99.9				99.9	99.9
	4									99.9	99.6			99.9	99.9	99.9	99.7			99.9	97.0
	5													99.9		99.8				99.9	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13a. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	H		N		C_{org}		C_{min}		Na		Mg		Al		K		Ca		Fe	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Sr	1					99.1		99.9	99.9									99.9	99.9		
	2		99.7				99.9	99.8	99.9	98.4	98.3							99.9	99.9		
	3							99.9	99.9									99.9	99.9		
	4							99.9	99.9									99.9	99.8		
	5					96.4		99.9										99.9			
Ta	1			98.5							97.5			99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.9			99.9	99.9
	3	99.7		99.3	96.7	99.8				99.9	99.6			99.9	99.9	99.9	99.6			99.9	99.9
	4		95.3		98.0					99.9	99.2			99.9	99.9	99.9	98.0			99.9	
	5													99.9		99.9				99.9	
Tb	1			98.5	98.8									99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.9			99.9	99.8
	3									99.8	99.9			99.9	99.9	99.9				99.9	99.8
	4									99.9				99.9		99.9				99.9	99.2
	5													99.9		99.9				99.9	
Th	1													99.9	99.9	99.9	95.2			99.9	
	2										95.2			99.9		99.9				99.9	
	3									99.9	98.9			99.9	99.9	99.9				99.9	99.6
	4						96.5			99.9				99.9		99.9				99.9	97.5
	5																				
Ti	1			98.1	98.9							96.8		99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	98.9	99.9			99.9	99.9
	3									99.7	95.5			99.9	99.9	99.9	98.9			99.9	99.9
	4		95.7		95.9					99.9	99.9			99.9	97.4	99.9				99.9	
	5													99.9		99.7				99.9	
U	1	99.9	99.9	99.9	99.8	99.9	99.9														
	2	99.9	99.9	97.6	98.3	99.8	99.9				99.5										
	3	98.5	99.1	99.0		98.8	98.6			99.3				99.9		99.9				99.9	96.4
	4		98.3	99.8	96.5									99.9		99.9				99.9	
	5			98.7																	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13a. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	H		N		C_{org}		C_{min}		Na		Mg		Al		K		Ca		Fe	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
V	1	99.3	98.4	99.9	99.8		96.1							99.9	99.9	99.9	99.3			99.9	99.9
	2	95.1		99.6													99.1				96.0
	3	99.9	99.9	99.9	99.9	99.9	99.9			99.9				99.9	99.9	99.9	99.9			99.9	99.9
	4			99.2						99.9	99.9			99.9	99.5	99.9	96.1			99.9	96.6
	5													99.8						98.2	
W	1			98.2										95.7						95.5	97.4
	2																				
	3	99.9		99.9		99.9				99.9				99.8		99.9				99.1	
	4				95.0						98.2				99.2		96.1				97.8
	5																				
Y	1				97.8									99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	99.9	99.9	99.9			99.9	99.6
	3							98.4			97.3				99.0						
	4									99.9	98.9			99.9	99.9	99.9	99.9			99.9	
	5													99.9		99.9				99.9	
Yb	1			95.0	99.9									99.9	99.9	99.9	99.9			99.9	99.9
	2													99.9	98.9	99.9	98.9			99.9	95.5
	3									99.9	99.1			99.9	99.9	99.9				99.9	99.8
	4		96.3		97.7					99.9	99.8			99.9	99.9	99.9	98.5			99.9	95.0
	5													99.9		99.9				99.9	
Zn	1			96.4	99.9									99.9	99.9	99.9	99.9			99.9	99.9
	2			96.9										96.0	99.9	96.4	99.9			99.9	99.9
	3	99.9	99.9	99.9	99.9	99.9	99.9			99.9	99.1			99.9	99.9	99.9	99.3			99.9	99.9
	4									99.9	97.1			99.9	99.9	99.9	97.4			99.9	99.6
	5													99.7						99.7	
Zr	1									99.6				99.9	99.9	99.8	99.7			99.9	
	2													99.9	99.9	96.1	99.9			98.1	99.9
	3									97.0				99.9		98.8				99.9	
	4									99.9				99.9		99.9				99.9	
	5													99.9		98.8				99.9	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13b. Statistical significance values for 48 elements paired with 29 elements.

Core	Hole	B		F		Ti		Cr		Mn		Co		Ni		Cu		Zn		Zr	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Al	1	99.9	99.9			99.9	99.9	99.9	99.9		96.1	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9
	2	96.0	99.9			99.9	99.9	99.9	99.9	99.9	99.9							96.0	99.9	99.9	99.9
	3	99.9	95.0	99.9		99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	
	4					99.9	97.4	99.9	99.4	99.9	98.8	99.9	99.4	99.9	99.9	99.9	98.8	99.9	99.9	99.9	
	5	96.0				99.9		99.9		99.9		99.7		99.5		99.8		99.7		99.9	
As	1											95.4	99.9		97.8	99.7	99.9		96.0		
	2											99.9				99.9		97.3			
	3						99.5		99.9	99.7			99.9	97.3	99.8		99.9		99.9		
	4						98.1				96.7	99.9	99.3	99.9	97.9	99.7	99.6		97.2		
	5	99.8						98.0				96.1		98.6				99.8		98.9	
B	1					99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.7	99.4	99.9	99.9	99.9
	2						99.9	98.0	99.9	97.6	99.7								99.9		99.9
	3			99.8		99.9		99.9				99.9	99.9	99.9	99.9	99.9	99.9	99.8	99.9	99.6	
	4								96.1			99.5		98.6		98.8					
	5																	99.9		99.1	
Ba	1				96.2																
	2																				
	3									99.8	98.1									98.4	
	4																				
	5																				
C_{min}	1																				
	2																				
	3									99.9	99.5										
	4																				
	5																				
C_{org}	1			96.8																	
	2												97.3			96.1					
	3	99.8	99.9	98.6				99.9	99.1			99.9	99.9	99.8	99.9	99.9	99.9	99.9	99.9		
	4	95.7																			
	5																				

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13b. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	B		F		Ti		Cr		Mn		Co		Ni		Cu		Zn		Zr	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Ca	1																				
	2																				
	3									99.6	99.7										
	4																				
	5																				
Cd	1		99.7						97.5				96.3		96.1		99.9		99.9		99.9
	2												99.3				99.8				
	3								99.6				99.8		98.7		99.9		99.9		
	4												99.8		97.3		99.9		99.8		
	5																				
Ce	1	99.9	99.9			99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9
	2		99.9			99.7	99.9	99.9	99.9	99.9	99.5								99.0	99.9	99.9
	3	99.9		99.7		99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.8	99.9	99.9	99.9	99.9	99.9	
	4					99.9	98.4	99.9	99.7	99.9	99.4	99.9	99.4	99.9	99.9	99.9	98.6	99.9	99.6	99.9	
	5					99.9		99.9		99.9		99.8		99.9		99.9		98.8		99.9	
Co	1	99.9	99.9			99.9	99.9	99.9	99.9					99.9	99.9	99.9	99.9	99.9	99.9	99.9	
	2													99.9	99.9	99.9	99.9	99.4	96.2		
	3	99.9	99.9	99.9		99.9	97.6	99.9	99.9					99.9	99.9	99.9	99.9	99.9	99.9	98.8	
	4	99.5				99.9	97.6	99.9	98.0	99.0	97.5			99.9	99.7	99.9	99.9	99.9	99.9		
	5					99.9		99.8		98.8				99.9		99.9		99.9		99.6	
Cr	1	99.9	99.9			99.9	99.9					99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	
	2	98.0	99.9			99.5	99.9			99.9	99.9								99.9	99.9	99.9
	3	99.9		99.9		99.9	98.5					99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.7	
	4		96.1			99.9				99.9		99.9	98.0	99.9	96.6	99.9	96.6	99.9	98.1	99.9	
	5					99.9				99.9		99.8		99.9		99.8		99.6		99.9	
Cs	1						99.5		99.9				99.9		99.9	99.6	99.9		99.9	99.9	96.2
	2			98.4	98.3																
	3	99.9		99.7		99.9		99.9	99.6			99.9	97.3	99.9	96.5	99.9	97.5	99.9	97.9	99.8	97.8
	4					98.3		95.5					95.6				98.1		95.6		
	5	97.9				98.3		98.8				98.2						97.7		99.9	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13b. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	B		F		Ti		Cr		Mn		Co		Ni		Cu		Zn		Zr	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Cu	1	99.9	99.7			98.2	99.9	99.9	99.9			99.9	99.9	99.9	99.9			99.9	99.9	99.9	
	2											99.9	99.9	99.9	95.3			99.7			
	3	99.9	99.9	99.9		99.9	98.8	99.9	99.9			99.9	99.9	99.9	99.9			99.9	99.9	98.7	
	4	98.8				99.9	96.9	99.9	96.6	99.2	96.2	99.9	99.9	99.9	99.5			99.9	99.9		
	5					99.8		99.8		98.0		99.9		99.9				99.7		98.1	
Dy	1	99.9	99.9			99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.8	99.9	99.9	99.9	99.9	99.9	99.9
	2		97.1				99.5	99.9	96.9	99.9	99.9								96.8	96.8	99.2
	3	99.8		99.6		99.9	99.9	99.9	99.7		96.2	99.9	96.0	99.9		99.9	99.4	99.9	98.8	99.9	
	4					99.9	97.0	99.9	99.9	99.9	98.5	99.9	99.6	99.9	99.7	99.9	99.1	99.9	99.8	99.9	
	5					99.9		99.9		99.9		99.8		99.9		99.9		99.1		99.9	
Eu	1	99.9	99.9			99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9
	2		99.4			99.6	99.9	99.9	99.9	99.9	99.8							95.2	98.3	99.9	99.9
	3	99.6		99.2		99.9	99.8	99.9	99.9		95.9	99.9	99.0	99.9	98.9	99.9	99.7	99.9	99.6	99.9	95.6
	4					99.9	98.3	99.9	99.4	99.9	99.5	99.9	99.6	99.9	99.9	99.9	98.9	99.9	99.8	99.9	
	5	96.5				99.9		99.9		99.9		99.9		99.9		99.9		99.7		99.9	
F	1																				
	2																				
	3	99.8				99.3		99.9				99.9		99.6		99.9		99.7		99.1	
	4																				
	5																				
Fe	1	99.9	99.9			99.9	99.9	99.9	99.9	97.5	98.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	
	2		99.9			99.9	99.9	99.9	99.9	99.7	99.9	98.6	97.8	95.5	97.6	99.1		99.9	99.9	98.1	99.9
	3	99.9	99.6	99.9		99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	
	4					99.9		99.9	95.3	99.9		99.9	97.2	99.9	97.2	99.9	98.2	99.9	99.6	99.9	
	5					99.9		99.9		99.9		99.9		99.9		99.9		99.7		99.9	
Ga	1	99.9	99.9			99.9	99.9	99.9	99.9		97.8	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.8
	2	96.9	99.9			99.2	99.9	99.9	99.9	99.9	99.9							95.6	99.9	99.6	99.9
	3	99.6		99.9		99.9	99.9	99.9	99.9			99.9	99.5	99.9	99.9	99.9	99.9	99.9	99.9	99.9	
	4					99.9	95.1	99.9	98.3	99.9	98.0	99.9	97.7	99.9	99.5	99.9	95.1	99.9	98.8	99.9	
	5					99.9		99.9		99.9		99.9		99.9		99.9		99.5		99.9	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13b. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	B 15/16	B 25	F 15/16	F 25	Ti 15/16	Ti 25	Cr 15/16	Cr 25	Mn 15/16	Mn 25	Co 15/16	Co 25	Ni 15/16	Ni 25	Cu 15/16	Cu 25	Zn 15/16	Zn 25	Zr 15/16	Zr 25
H	1			97.3								97.6	98.5			97.9					
	2																				
	3	99.7	99.9	98.4				99.9	98.9			99.9	99.9	99.5	99.9	99.9	99.9	99.9	99.9		
	4	98.5					95.7				96.0		96.8								
	5																				
Hf	1	99.7	99.9			98.7	95.4	99.9	96.3			99.9	98.2	99.9	95.9	99.9		99.9	99.1	99.9	99.9
	2		99.7			98.3	99.9		99.9		97.9								98.2	99.4	99.9
	3	99.9		99.9		99.9	96.5	99.9	99.9			99.9	98.0	99.9	98.9	99.9	95.9	99.9	98.8	99.9	99.8
	4					99.9		99.9		99.9		99.0		99.9		98.2		99.9		99.9	99.9
	5	98.8				99.9		99.9		99.9		99.5		98.0		96.7		99.6		99.9	
Hg	1	99.2										99.9	96.3	99.9		99.9	99.9	99.3	96.2		
	2											99.7	99.8		99.5	99.9	99.9	96.8			
	3	99.0	99.4	99.5		98.1		98.3	99.7			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.7	97.3	
	4						95.8		95.2		98.2	95.2	98.4		98.6		98.7		98.3		
	5	99.9				98.4		98.1		97.7		98.8		99.2		95.6		99.9		99.7	
K	1	99.9	99.9			99.9	99.9	99.9	99.9			99.9	99.8	99.9	99.0	99.9	99.9	99.9	99.9	99.8	99.7
	2	99.8	99.9			98.9	99.9	99.9	99.9	99.9	99.9							96.4	99.9	96.1	99.9
	3	99.9	99.9	99.9		99.9	98.9	99.9	97.0			99.9	99.7	99.9	99.8	99.9	99.7	99.9	99.8	98.8	
	4		98.8			99.9		99.9	98.9	99.9		99.9		99.9	97.1	99.9		99.9	97.4	99.9	
	5					99.7		99.9		99.9		98.2		96.8		98.1				98.8	
La	1	99.9	99.9			99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9
	2		99.8			99.7	99.9	99.9	99.9	98.8	98.9	95.3						96.5	99.5	99.9	99.9
	3	99.8		99.6		99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	
	4					99.9	99.1	99.9	99.0	99.9	99.8	99.9	99.5	99.9	99.9	99.9	99.0	99.9	99.7	99.9	
	5					99.9		99.9		99.9		99.8		99.9		99.9		98.6		99.9	
Mg	1		96.7			96.8															
	2				99.6																
	3				95.2																
	4																				
	5																				

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13b. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	B		F		Ti		Cr		Mn		Co		Ni		Cu		Zn		Zr	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Mn	1																				
	2	97.6	99.7				99.9	99.9	99.9										99.5	98.1	99.9
	3																				99.9
	4					99.9	99.9	99.9				99.0	97.5	99.1	99.8	99.2	96.2	99.9	96.0	99.9	
	5					99.9		99.9				98.8		99.6		98.0		97.7		99.9	
Mo	1			99.4								99.0	99.8	96.5	99.3	99.8	99.5				
	2				99.3							99.9	98.6	97.8		98.1	97.8				
	3	99.9	99.9	99.6	95.9	99.2		99.9	99.5			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.7	
	4											99.9		96.1		99.8					
	5																				
N	1	99.9	99.6			98.1	98.9		99.0			99.9	99.9	99.9	99.9	99.9	99.9	96.4	99.9		
	2											95.5				98.4		96.9			
	3	99.9	99.9	96.4				99.6	99.0			99.9	99.9	98.9	99.9	99.9	99.9	99.9	99.9		
	4	98.6					95.9				96.9	99.9	98.1	95.8	95.3	99.6	96.1				
	5																				
Na	1																			99.6	
	2																				
	3	98.3		99.7		99.7	95.5	99.9	99.5			99.9	98.5	99.9	98.8	99.9	99.0	99.9	99.1	97.0	
	4					99.9	99.9	99.9	96.6	99.9	99.9	99.3	98.8	99.9	99.7	99.5	97.8	99.9	97.1	99.9	
	5																				
Nd	1	99.9	99.9			99.9	99.3	99.9	99.9			99.9	97.4	99.9	97.9	99.9	97.7	99.9	99.9	99.9	99.6
	2		99.9			98.7	99.9	99.9	99.9	99.9	99.9								99.7	99.7	99.9
	3	99.9		99.1		99.9	98.2	99.9	99.9		96.8	99.9	97.3	99.9	96.5	99.9	99.1	99.9	99.3	99.9	97.3
	4					99.9	98.2	99.9	98.2	99.9	98.8	99.9	99.9	99.9	99.9	99.9	99.8	99.9	99.9	99.9	
	5					99.8		99.9		99.9		99.0		99.9		99.6		98.4		99.9	
Ni	1	99.9	99.9			99.5	99.9	99.9	99.9			99.9	99.9			99.9	99.9	99.7	99.9	99.9	
	2					95.9						99.9	99.9			99.9	95.3	96.3	96.4		
	3	99.9	99.9	99.6		99.9	99.5	99.9	99.9			99.9	99.9			99.9	99.9	99.9	99.9	99.7	
	4	98.6				99.3	99.7	99.9	99.6	99.1	99.8	99.9	99.7			99.9	99.5	99.9	99.8	99.5	
	5					99.9		99.9		99.6		99.9				99.9		99.3		98.7	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13b. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	B		F		Ti		Cr		Mn		Co		Ni		Cu		Zn		Zr	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Pb	1	99.9	99.9			99.1	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	
	2											99.9	99.9	99.9	99.5	99.9	99.9	95.7	97.8		
	3	99.9	99.9	99.9		99.9	98.0	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.2	
	4	98.8				99.9	98.3	99.9	96.1	99.0	97.8	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9		
	5											99.9		98.0		99.9		95.8			
Rb	1	99.9	99.9			99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.4
	2	95.1	99.9			99.9	99.9	99.9	99.9	98.1	99.9								99.9	99.2	99.9
	3	99.9	99.9	99.8	96.4	99.9		99.9	96.1			99.9	99.7	99.9	99.8	99.9	99.8	99.9	99.9	99.9	
	4					99.9		99.9	98.1	99.9		99.9		99.6	95.1	99.9		99.9		99.9	
	5					99.9		99.9		99.9		99.7				98.6		97.8		99.9	
Sb	1	99.9	99.1			99.8	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	
	2											99.9	99.9	99.0	99.3	99.9	99.9	97.9	96.7		
	3	98.7	97.9	99.6		99.8	99.1	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	98.8	
	4	99.1				97.4	99.6	99.3	97.6		99.8	99.9	99.9	99.9	99.8	99.9	99.7	99.9	99.1		
	5	97.9				99.9		99.9		99.9		99.9		99.9		99.9		99.9		99.9	
Sc	1	99.9	99.9			99.9	99.9	99.9	99.9	96.5		99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	97.7
	2	99.5	99.9			99.5	99.7	99.9	99.5	99.9	99.9							98.6	97.9	98.5	99.9
	3	99.9	97.2	99.9		99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	
	4					99.9		99.9		99.9		99.9		99.9		99.9		99.9	96.5	99.9	
	5	95.2				99.9		99.9		99.9		99.9		99.9		99.9		99.6		99.9	
Se	1															99.8	99.9				
	2											99.9	99.9	98.5		99.9	99.9				
	3								99.8			96.8	99.8	99.8	99.0	98.1	99.8	99.4	99.4		
	4	99.9										99.9	99.3	99.9	96.1	99.9	99.9	97.3	98.4		
	5			96.9																	
Sm	1	99.9	99.9			99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9
	2		99.0			96.7	99.9	99.9	99.3	99.9	99.9								98.0	99.7	99.8
	3	99.7		98.9		99.9	99.9	99.9	99.9			99.9	99.5	99.9	99.4	99.9	99.9	99.9	99.9	99.9	
	4					99.9	98.4	99.9	99.7	99.9	99.4	99.9	99.4	99.9	99.9	99.9	98.5	99.9	99.6	99.9	
	5					99.9		99.9		99.9		99.7		99.9		99.9		99.0		99.9	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13b. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core Hole		B		F		Ti		Cr		Mn		Co		Ni		Cu		Zn		Zr	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Sr	1																				
	2																				
	3									98.9	98.7										
	4																				
	5																				
Ta	1	99.9	99.9			99.9	98.9	99.9	96.0			99.9		99.9		99.5		99.9	99.8	99.9	99.9
	2		99.9			99.6	99.9	99.9	99.9	97.1	97.6								99.6	99.9	99.8
	3	99.9		99.9		99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	
	4					99.9	96.7	99.9	99.3	99.9	98.5	99.9	99.6	99.9	99.6	99.9	98.4	99.9	99.4	99.9	
	5					99.9		99.9		99.9		99.9		99.8		99.9		99.6		99.9	
Tb	1	99.9	99.9			99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.8
	2		98.3				99.8	99.9	98.2	99.9	99.9								99.1	98.8	99.9
	3	98.9		97.1		99.9	99.7	99.1	99.6		97.0	99.9	97.3	99.9	96.9	99.9	99.6	99.9	99.2	99.7	
	4					99.9		99.9		99.9		99.9		99.9		99.9		99.9	95.4	99.9	
	5					99.9		99.9		99.9		99.9		99.9		99.9		99.7		99.9	
Th	1	95.8	99.7	96.9		99.3		99.9								96.3		99.8		98.9	99.1
	2					99.8		99.9		99.8										99.9	
	3	99.5		99.5		99.9	99.9	99.9	98.7			99.9		99.9		99.9	99.0	99.9	97.5	99.9	
	4					99.9		99.9		99.9		99.7		99.4		99.7		99.9		99.9	
	5													97.1		96.4					
Ti	1	99.9	99.9					99.9	99.9			99.9	99.9	99.5	99.9	98.2	99.9	99.7	99.9	99.9	
	2		99.9					99.5	99.9		99.9			95.9				95.8	99.9	99.7	99.9
	3	99.9		99.3				99.9	98.5			99.9	97.6	99.9	99.5	99.9	98.8	99.5	99.4	99.9	
	4							99.9		99.9	99.9	99.9	97.6	99.3	99.7	99.9	96.9	99.9	95.7	99.9	
	5							99.9		99.9		99.9		99.9		99.8		98.9		99.9	
U	1		98.1	99.9								99.6	97.9	99.7	98.0	98.9					
	2											99.4		95.5		99.1					
	3	99.9		99.8		99.9		99.9				99.9	96.0	99.9		99.9	95.5	99.9		99.9	
	4					98.3		99.9				99.9		99.9		99.9		99.9			
	5					95.2						98.2		99.7		99.3					

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13b. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	B		F		Ti		Cr		Mn		Co		Ni		Cu		Zn		Zr	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
V	1	99.9	99.9			99.8	99.8	99.9	99.9			99.9	99.9	99.9	99.8	99.9	99.9	99.9	99.9	99.9	
	2		99.0									99.0		96.7		99.4			95.9		99.2
	3	99.9	99.9	99.9		99.1	99.4	99.9	99.3			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	96.7	
	4					99.9	99.9	99.9	98.5	98.8	99.8	99.9	99.5	99.9	99.9	99.9	99.5	99.9	99.2	98.1	
	5	98.8				95.0		99.7		97.4		99.0		99.6		99.7		99.7		99.7	
W	1	99.9				99.3				98.4	98.5		99.1		99.7						
	2											95.8									
	3	99.6		96.3				99.6				99.9		98.0		99.9		99.9			
	4						95.1		98.5		96.3		99.9		99.0		99.9		99.9		
	5																				
Y	1	98.1	99.9			99.9	99.9	99.9	99.9			99.9	97.5	99.8	98.9	99.9	99.8	99.9	99.9	99.9	99.9
	2		99.2				99.9	99.9	98.8	99.9	99.9								98.2	98.1	99.8
	3					99.1	99.5			99.9	99.9									99.0	96.5
	4		96.0			99.9	96.9	99.9	99.8	99.9	99.0	98.5	96.6	99.2	99.0	99.2		99.9	97.7	99.9	
	5					99.9		99.9		99.9		99.5		99.8		99.6		97.6		99.9	
Yb	1	99.9	99.9			99.9	99.9	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9
	2		96.9				98.1	99.9		99.9	99.9									96.1	99.1
	3	99.8		99.5		99.9	99.9	99.9	99.2			99.9	96.5	99.9	97.1	99.9	99.6	99.9	99.0	99.9	
	4					99.9	98.3	99.9	99.8	99.9	99.3	99.9	99.8	99.9	99.7	99.9	99.4	99.9	99.6	99.9	
	5					99.9		99.9		99.9		99.8		99.9		99.9		99.5		99.9	
Zn	1	99.4	99.9			99.7	99.9	99.9	99.9			99.9	99.9	99.7	99.9	99.9	99.9			99.9	
	2		99.9			95.8	99.9		99.9		98.5	99.4	96.2	96.3	96.4	99.7					99.9
	3	99.8	99.9	99.7		99.5	99.4	99.9	99.9			99.9	99.9	99.9	99.9	99.9	99.9			99.6	
	4					99.9	95.7	99.9	98.1	99.9	96.0	99.9	99.9	99.9	99.8	99.9	99.9			99.9	
	5	99.9				98.9		99.6		97.7		99.9		99.3		99.7				99.6	
Zr	1	99.9	99.9			99.9		99.9				99.9		99.9		99.9		99.9			
	2		99.9			99.7	99.9	99.9	99.9	98.1	99.9								99.9		
	3	99.6		99.1		99.9		99.7			99.9	98.8		99.7		98.7		99.6			
	4					99.9		99.9		99.9				99.5				99.9			
	5	99.1				99.9		99.9		99.9		99.6		98.7		98.1		99.6			

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13c. Statistical significance values for 48 elements paired with 29 elements.

		As		Se		Cd		Mo		Sb		Hg		Pb		Th		U	
Core Hole		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Al	1						99.9			99.9	99.9			99.9	99.9	99.9	99.9		
	2															99.9			
	3		99.9		96.2		99.9	99.9	98.9	99.9	99.9	99.9		99.9	99.9	99.9	99.9	99.9	
	4						95.9			99.7	99.1		98.4	99.9	99.6	99.9		99.9	
	5	98.7								99.9		99.3							
As	1			99.9	99.9		99.8	99.9	99.9	99.8	99.9	99.9	99.9		99.0			96.9	99.8
	2			99.9	99.5			95.0	99.8	99.9		99.9	99.8	99.7				97.8	99.6
	3			99.9	99.9		99.9		97.0	99.9	99.9	99.5	99.9		99.9	97.9	99.4		
	4			99.9	99.9		98.9	99.9		99.9	99.5		97.4	98.4	99.2				
	5									99.7		99.9				95.1		99.2	
B	1						99.7			99.9	99.1	99.2		99.9	99.9	95.8	99.7		98.1
	2																		
	3							99.9	99.9	98.7	97.9	99.0	99.4	99.9	99.9	99.5		99.9	
	4			99.9						99.1				98.8					
	5	99.8								97.9		99.9							
Ba	1			99.1	99.7		99.6				98.3								
	2																		
	3																		
	4															95.9			
	5																		
C_{min}	1																		
	2																		
	3																		
	4																		
	5							95.1											
C_{org}	1	99.9	99.9	99.9	99.9			99.9	99.9		99.0	99.9	99.8		97.7			99.9	99.9
	2		99.7	99.9	96.0			99.9	99.9			97.9		98.7				99.8	99.9
	3		97.5		98.5		97.1	99.9	99.9	98.9	98.9	97.9	99.9	99.9	99.9			98.8	98.6
	4	99.9	97.3	99.9	97.8		96.2	99.9	99.9	96.8							96.5		
	5			96.2				99.9											

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13c. Statistical significance values for 48 elements paired with 29 elements (Continued).

		As		Se		Cd		Mo		Sb		Hg		Pb		Th		U	
Core	Hole	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Ca	1			96.9															
	2																		
	3																		
	4																		
	5																		
Cd	1		99.8		99.7				96.7		99.9		99.9		99.5		99.8		
	2				96.3						99.6		95.5		98.0				
	3		99.9		99.5				99.4		99.9				99.9		95.2		
	4		98.9		99.8				95.2		97.2		95.2		99.8		98.9		
	5																		
Ce	1						99.9			99.9	99.9	95.0		99.9	99.9	99.9	99.9		
	2															99.9			
	3	99.3	99.9	99.6	99.0		99.9	99.9		99.9	99.9	99.9		99.9	99.9	99.9	99.9	99.9	
	4									99.6	99.6		98.7	99.9	99.3	99.9		99.9	
	5	99.7								99.7		99.1				99.9		99.7	
Co	1	95.4	99.9				96.3	99.0	99.8	99.9	99.9	99.9	96.3	99.9	99.9			99.6	97.9
	2	99.9		99.9	99.9		99.3	99.9	98.6	99.9	99.9	99.7	99.8	99.9	99.9			99.4	
	3		99.9	96.8	99.8		99.8	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9		99.9	96.0
	4	99.9	99.3	99.9	99.3		99.8	99.9		99.9	99.9	95.2	98.4	99.9	99.9	99.7		99.9	
	5	96.1								99.9		98.8		99.9				98.2	
Cr	1						97.5			99.9	99.9			99.9	99.9	99.9			
	2															99.9			
	3		99.9		99.8		99.6	99.9	99.5	99.9	99.9	98.3	99.7	99.9	99.9	99.9	98.7	99.9	
	4									99.3	97.6		95.2	99.9	96.1	99.9		99.9	
	5	98.0								99.9		98.1							
Cs	1										99.9	95.1			99.9				
	2																		
	3		99.9	96.5	98.1		98.4	99.9		99.9	98.5	99.9		99.9	96.8	99.9	96.4	99.9	
	4		98.6		99.6		99.5		98.8					98.7	97.9	99.9	98.9		
	5	98.1		97.3						98.6		98.9						95.7	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13c. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core Hole		As		Se		Cd		Mo		Sb		Hg		Pb		Th		U	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Cu	1	99.7	99.9	99.8	99.9		99.9	99.8	99.5	99.9	99.9	99.9	99.9	99.9	99.9	96.3		98.9	
	2	99.9		99.9	99.9		99.8	98.1	97.8	99.9	99.9	99.9	99.9	99.9	99.9			99.1	
	3		99.9	98.1	99.8		99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.0	99.9	95.5
	4	99.7	99.6	99.9	99.9		99.9	99.8		99.9	99.7		98.7	99.9	99.9	99.7		99.9	
	5									99.9		95.6		99.9		96.4		99.3	
Dy	1						99.9			99.9	99.9			98.3	99.9	99.9	99.9		
	2															99.9			
	3	97.4	99.9	98.4	96.9		99.5	99.9		99.9	99.7	99.9		99.9	96.3	99.9	99.9	99.9	
	4						96.4			98.8	99.5		98.5	99.9	99.4	99.9		99.9	
	5	98.7								99.9		99.2				98.6			
Eu	1						99.9			99.9	99.9	98.0		99.9	99.9	99.9	99.9		
	2															99.9			
	3	99.9	99.9	99.9	99.1		99.7	99.9		99.9	99.9	99.9		99.9	98.5	99.9	99.9	99.9	
	4						95.3			99.5	99.7		99.2	99.9	99.5	99.9		99.9	
	5	99.8								99.9		99.8				99.7		98.9	
F	1							99.4								96.9		99.9	
	2								99.3										
	3							99.6	95.9	99.6		99.5		99.9		99.5		99.8	
	4																		
	5			96.9															
Fe	1						99.5			99.9	99.9	98.2		99.9	99.9	99.9			
	2	95.2								96.0	97.3				97.2	99.9			
	3		99.8	96.7			99.6	99.9	99.9	99.9	99.9	99.9	98.9	99.9	99.9	99.9	99.6	99.9	96.4
	4						98.8			99.9				99.9	99.3	99.9	97.5	99.9	
	5	95.9								99.9		98.2		97.9					
Ga	1						99.5			99.9	99.9			99.9	99.9	99.9	98.5		
	2															99.9			
	3		99.9	96.9			99.5	99.9		99.9	99.9	99.9		99.9	99.8	99.9	99.9	99.9	
	4									99.6	97.5		96.3	99.9	97.4	99.9		99.2	
	5	97.8								99.9		99.2							

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13c. Statistical significance values for 48 elements paired with 29 elements (Continued).

Core	Hole	As		Se		Cd		Mo		Sb		Hg		Pb		Th		U	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
H	1	99.9	99.9	99.9	99.2			99.9	99.9		96.3	99.9	97.2	98.5	99.4			99.9	99.9
	2	95.1	99.8	99.9	97.0			99.7	99.9			98.5		97.9				99.9	99.9
	3		95.4		95.7		95.8	99.9	99.9	98.1	97.8	97.2	99.9	99.9	99.9			98.5	99.1
	4	99.9	98.3	99.9				99.9		97.6	99.0								98.3
	5							99.9											
Hf	1						99.3			99.9		98.9		99.9	99.9	99.9	99.9	97.9	
	2																		
	3		98.5				95.1	99.9		99.9	95.9	99.8		99.9	97.8	99.9		99.9	
	4									97.5				97.3		99.9		99.4	
	5	98.7								99.9		99.7							
Hg	1	99.9	99.9	99.9	99.9		99.9	99.9	99.7	99.9	99.9			99.7				99.9	98.7
	2	99.9	99.8	99.9	99.9		95.5	96.4	98.9	99.6	99.9			99.0	99.0			98.3	
	3	99.5	99.9	99.9	99.8			99.9	99.6	99.9	99.4			99.9	99.9	99.9		99.9	
	4		97.4	98.9	98.2		95.2			99.4	99.6				98.9				
	5	99.9								99.7								95.7	
K	1						99.9			99.9	99.4			99.9	98.3	99.9	95.2		
	2															99.9			
	3			98.0				99.9	99.3	99.9	98.4	99.9		99.9	99.7	99.9		99.9	
	4									99.2			96.6	99.9	95.1	99.9		99.9	
	5									99.8									
La	1						99.9			99.9	99.9			99.9	99.9	99.9	99.9		
	2															99.9			
	3	99.0	99.9	99.5	98.5		99.9	99.9	98.6	99.9	99.9	99.9	95.8	99.9	99.9	99.9	99.9	99.9	
	4		95.1				95.2			99.7	99.8		99.4	99.9	99.6	99.9		99.9	
	5	99.8								99.7		99.1				99.9		99.9	
Mg	1																		
	2																		
	3																		
	4																		
	5																		

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13c. Statistical significance values for 48 elements paired with 29 elements (Continued).

		As		Se		Cd		Mo		Sb		Hg		Pb		Th		U	
	Core Hole	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Mn	1																		
	2															99.8			
	3	99.7																	
	4		96.7								99.8		98.2	99.0	97.8	99.9			
	5									99.9		97.7							
Mo	1	99.9	99.9	99.9	98.1		96.7			98.7	99.8	99.9	99.7	99.9	99.9			99.9	99.9
	2	95.0	99.8	99.9	99.9					96.4		96.4	98.9	99.9	98.9			99.9	99.8
	3		97.0	98.6			99.4			99.9	99.8	99.9	99.6	99.9	99.9	99.9		99.9	96.7
	4	99.9		99.8	97.6		95.2			99.9				99.9			95.9	99.9	95.2
	5			98.6															
N	1	97.6	99.9	99.5	99.5		99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9			99.9	99.8
	2	99.2	96.6							97.7		98.1						97.6	98.3
	3		95.2		96.5		98.2	99.9	99.9		99.2	97.5	99.9	99.9	99.9			99.0	
	4	99.9	98.4	99.9				99.9		99.8	99.4			99.3				99.8	96.5
	5							98.1										98.7	
Na	1																		
	2				95.6			98.7	99.8								95.2		99.5
	3		99.9		97.6		99.7	99.9		99.9	99.5	99.5	96.2	99.9	98.8	99.9	98.9	99.3	
	4		98.0							99.5	99.9		99.1	99.7	98.3	99.9			
	5																		
Nd	1						99.5			99.9		96.3		99.9	97.9	99.9	99.9		
	2															99.9			
	3	98.3	99.9	98.8	99.6		99.8	99.9		99.9	99.5	99.9		99.9	97.5	99.9	99.8	99.9	
	4		97.5		96.9		98.6			99.1	99.8		98.6	99.9	99.9	99.9		99.9	
	5	99.8								98.8		98.9				99.9		99.8	
Ni	1		97.8				96.1	96.5	99.3	99.9	99.9	99.9		99.9	99.9			99.7	98.0
	2			98.5				97.8		99.0	99.3		99.5	99.9	99.5			96.5	
	3	97.3	99.8	99.8	99.0		98.7	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9		99.9	
	4	99.9	97.9	99.9	96.1		97.3	96.1		99.9	99.8		98.6	99.9	99.9	99.4		99.9	
	5	98.6								99.9		99.2		98.0		97.1		99.7	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13c. Statistical significance values for 48 elements paired with 29 elements (Continued).

		As		Se		Cd		Mo		Sb		Hg		Pb		Th		U	
Core	Hole	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Pb	1		99.0		97.3		99.5	99.9	99.9	99.9	99.9	99.7				98.2		99.9	97.8
	2	99.7		99.9	99.9		98.0	99.9	98.9	99.9	99.7	99.0	99.0					99.8	
	3		99.9		99.7		99.9	99.9	99.9	99.9	99.9	99.9	99.9			99.9		99.9	
	4	98.4	99.2	99.9	99.4		99.8	99.9		99.9	99.6		98.9			99.8		99.9	
	5			96.9						95.4									
Rb	1						99.9			99.9	99.9	97.2		99.9	99.9	99.9			
	2															99.9			
	3			98.5			99.4	99.9	99.9	99.9	98.7	99.9		99.9	99.9	99.9		99.9	
	4									97.9				99.9		99.9		99.8	
	5									99.9									
Sb	1	99.8	99.9	99.9	99.9		99.9	98.7	99.8			99.9	99.9	99.9	99.9	99.2	96.4	99.1	99.0
	2	99.9		99.9	98.3		99.6	96.4				99.6	99.9	99.9	99.7			96.8	
	3	99.9	99.9	99.9	99.9		99.9	99.9	99.8			99.9	99.4	99.9	99.9	99.9	98.7	99.9	
	4	99.9	99.5	99.9	98.4		97.2	99.9				99.4	99.6	99.9	99.6			99.9	
	5	99.7										99.7		95.4					
Sc	1						99.5			99.9	99.9	96.7		99.9	99.9	99.9	97.1		
	2															99.9			
	3	95.6	99.2	97.9			99.9	99.9	99.3	99.9	99.9	99.9		99.9	99.9	99.9	99.8	99.9	
	4						96.3			99.7				99.9	95.4	99.9	99.0	99.9	
	5	99.7								99.9		99.2				98.2		96.9	
Se	1	99.9	99.9				99.7	99.9	98.1	99.9	99.9	99.9	99.9		97.3			98.9	
	2	99.9	99.5				96.3	99.9	99.9	99.9	98.3	99.9	99.9	99.9	99.9			99.9	95.8
	3	99.9	99.9				99.5	98.6		99.9	99.9	99.9	99.8		99.7	98.6		96.9	
	4	99.9	99.9				99.8	99.8	97.6	99.9	98.4	98.9	98.2	99.9	99.4				
	5							98.6						96.9					
Sm	1						99.9			99.9	99.9	95.6		99.9	99.9	99.9	99.9		
	2															99.9			
	3	99.3	99.9	99.4	99.3		99.9	99.9		99.9	99.9	99.9		99.9	99.4	99.9	99.9	99.9	
	4									98.6	99.6		98.7	99.9	99.3	99.9		99.9	
	5	99.6								99.9		99.2				99.9		99.3	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13c. Statistical significance values for 48 elements paired with 29 elements (Continued).

		As		Se		Cd		Mo		Sb		Hg		Pb		Tn		U	
Core	Hole	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Sr	1	99.2		96.5															
	2																		95.2
	3																		
	4																		
	5							98.3											
Ta	1						99.6			99.9	99.1			99.9	99.9	99.9	99.9		
	2															99.9			
	3		99.9	95.7	97.3		99.9	99.9	98.0	99.9	99.9	99.9		99.9	99.9	99.9	99.6	99.9	
	4									97.3	99.4		96.7	99.9	98.5	99.9		99.8	
	5	96.8								99.9		98.1							
Tb	1						99.9			99.9	99.9			99.9	99.6	99.9	99.9		
	2															99.9			
	3	96.7	99.9	98.3	97.0		99.8	99.5		99.9	99.8	99.7		99.9	97.4	99.9	99.9	98.3	
	4									97.4				99.9		99.9	97.0	99.9	
	5	97.8								99.9		98.9				97.1			
Th	1						99.8			99.2	96.4			98.2					99.9
	2																		95.9
	3	97.9	99.4	98.6			95.2	99.9		99.9	98.7	99.9		99.9				99.9	97.1
	4						98.9		95.9					99.8				99.9	
	5	95.1																99.9	
Ti	1									99.8	99.9			99.1	99.9	99.3			
	2															99.8			
	3		99.5					99.2		99.8	99.1	98.1		99.9	98.0	99.9	99.9	99.9	
	4		98.1							97.4	99.6		95.8	99.9	98.3	99.9		98.3	
	5									99.9		98.4						95.2	
U	1	96.9	99.8	98.9				99.9	99.9	99.1	99.0	99.9	98.7	99.9	97.8		99.9		
	2	97.8	99.6	99.9	95.8			99.9	99.8	96.8		98.3		99.8			95.9		
	3			96.9				99.9	96.7	99.9		99.9		99.9		99.9	97.1		
	4							99.9	95.2	99.9				99.9		99.9			
	5	99.2										95.7				99.9			

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 13c. Statistical significance values for 48 elements paired with 29 elements (Continued).

		As		Se		Cd		Mo		Sb		Hg		Pb		Tn		U	
Core	Hole	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
V	1							99.3	97.0	99.9	99.9	96.8		99.9	99.9			99.7	95.2
	2	99.3		96.5				97.6		99.8		95.7		99.9				99.5	
	3		95.0				98.3	99.9	99.9	99.9	99.7	99.6	99.3	99.9	99.9	99.9		99.9	
	4	95.3	98.2	98.3	96.7		97.1	99.0		99.9	99.9		99.0	99.9	99.7	99.8		99.9	
	5	99.9								99.9		99.9						99.4	
W	1								96.6					98.9	99.4				
	2			95.1				96.4		98.4				95.3					
	3							99.9		95.9				99.9				95.7	
	4		98.5		99.6		99.6				99.7		99.8		99.9				
	5																		
Y	1						99.9			99.9	99.9				98.2	99.9	99.9		
	2															99.9			
	3	99.3	95.4													99.0	99.9		
	4										98.1		97.0	98.5	96.4	99.9		98.4	
	5	95.4								99.9		98.1				96.4			
Yb	1						99.9		97.9	99.9	99.9			99.8	99.9	99.9	99.9		99.9
	2															99.8			
	3	98.3	99.8	99.1			98.9	99.9		99.9	99.7	99.9		99.9	97.2	99.9	99.9	99.9	
	4		95.8				96.3			97.4	99.9		99.2	99.9	99.3	99.9		99.9	
	5	99.5								99.9		99.5				99.3		96.4	
Zn	1		96.0				99.9			99.9	99.9	99.3	96.2	99.9	99.9	99.8			
	2	97.3								97.9	96.7	96.8		95.7	97.8				
	3		99.9	99.4	99.4		99.9	99.9	99.9	99.9	99.9	99.9	99.7	99.9	99.9	99.9	97.5	99.9	
	4		97.2	97.3	98.4		99.8			99.9	99.1		98.3	99.9	99.9	99.9		99.9	
	5	99.8								99.9		99.9		95.8					
Zr	1						99.9			99.9				99.9		98.9	99.1		
	2															99.9			
	3							99.7		98.8		97.3		99.2		99.9		99.9	
	4															99.9			
	5	98.9								99.9		99.7							

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 14. Statistical significance values for 48 elements paired with 8 minerals, oil, and water.

		Analcime		Quartz		Calcite		Dolomite		Na Feld		K Feld		Mg Sider.		Pyrite		Oil		Water	
Core Hole		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Al	1			97.3						99.0	99.9	99.9	99.9	99.9							
	2			99.7								99.9	99.9		99.8						
	3									99.9		98.7	97.4	99.3		99.9		99.8			95.5
	4	99.7								96.6		99.9	99.9	99.9		97.5					
	5											98.0		99.9							
As	1																	99.9	99.9		
	2																		99.8		95.3
	3										97.1										
	4										99.3					99.7		99.3	98.6	99.9	
	5			99.9										98.6						99.9	
B	1								97.3			99.9	99.9	99.9	98.0						
	2							97.5					99.9	96.2							
	3			98.3						99.9	97.8	99.9	99.9	99.3		99.8	95.7	99.8	99.9		99.9
	4			99.7												99.4		98.6			
	5	99.0		99.9										97.7						99.9	
Ba	1					98.5															
	2	99.4				96.7													95.1		
	3					99.9	99.8														
	4					99.9	95.6														
	5					99.4															
C_{min}	1					99.9	99.9														
	2					95.6		99.9	99.9										95.9		
	3					99.9	97.2		98.9												
	4							99.9	99.4												
						99.9															
C_{org}	1										99.6					99.9		99.9	99.9		
	2																	99.9	99.9	98.7	99.9
	3									99.9	99.9	99.9	99.6			99.9	99.4	99.9	99.9	99.5	99.9
	4																	99.9	99.9		
	5															98.1		99.9			

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 14. Statistical significance values for 48 elements paired with 8 minerals, oil, and water (Continued).

		Analcime		Quartz		Calcite		Dolomite		Na Feld		K Feld		Mg Sider.		Pyrite		Oil		Water	
Core Hole		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Ca	1					99.9	99.9											96.9			
	2	97.9				99.7			98.3										99.8		
	3					99.9	99.9														
	4					99.9	95.5														
	5					99.9															
Cd	1												99.9		99.9						
	2																				
	3										96.8										
	4														96.6				97.3		
	5																				
Ce	1	97.8		98.9						99.7		99.9	99.9	99.9	96.8						
	2			99.1								99.9	99.9								
	3	98.8								99.9	99.9	95.0	99.4	98.8		98.0		96.3	99.9		99.9
	4	99.3									95.7	99.9	99.9	99.9	95.7	98.6					
	5													99.9							
Co	1									99.9	99.9	99.9	99.9	99.9							
	2									97.0	97.0				99.7						
	3									99.9		99.9		99.8		99.9		99.9			
	4										96.5	99.9	98.9	99.9	98.8	99.9				99.9	
	5											96.6		99.9							
Cr	1									99.9	99.7	99.9	99.9	99.9							
	2			96.5								99.9	99.9		98.4						
	3			97.7				95.5		99.9	98.7			99.8		99.9		99.9	97.4		
	4	98.1								98.7		99.9	98.5	99.2							
	5											96.3		99.8							
Cs	1	99.9	99.8							99.8	99.9									99.9	99.9
	2																			98.1	99.0
	3	95.4	99.0		96.9					99.9		99.8		96.9		99.9		99.9		95.2	
	4	99.9		96.2												95.4			99.8	99.8	
	5			99.6																99.8	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 14. Statistical significance values for 48 elements paired with 8 minerals, oil, and water (Continued).

Core Hole		Analcime		Quartz		Calcite		Dolomite		Na Feld		K Feld		Mg Sider.		Pyrite		Oil		Water	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Cu	1									98.2	99.9	99.9	99.9								
	2																				
	3									99.9	99.5	99.8	99.1	99.5		99.9		99.9	99.9		99.9
	4										96.2	99.7	97.1	99.9	96.5	99.9				99.9	
	5											97.5		99.9							
Dy	1									99.2		99.9	99.9	99.9	99.8						
	2			99.8	96.2							99.9	99.3								
	3	98.5								99.9				96.7							
	4	99.7										99.9	99.9	99.9			99.4				
	5											98.0		99.9							
Eu	1									99.7		99.9	99.9	99.9	97.2						
	2			98.2								99.9	99.9								
	3	93.6								99.6				97.9							
	4	99.0								97.1	95.9	99.9	99.9	99.9	97.5	97.4					
	5					95.6						95.4		99.9							
F	1															97.8		97.4			
	2																			95.4	99.7
	3				99.8				97.8	99.9				99.9		99.4		99.2			96.7
	4						95.6														
	5									99.0											
Fe	1									98.6	99.9	99.9	99.9	99.9							
	2			95.7								99.9	99.9		99.8						
	3									99.9		99.2	99.7	99.9		99.9		99.9	98.7		99.7
	4	98.9										99.9		99.9		99.8					
	5											99.8		99.9							
Ga	1	96.8		99.7						96.5	99.9	99.9	99.9	99.9							
	2			99.8								99.9	99.9		99.6						
	3									99.9				98.6		99.2		98.1			
	4	98.9								97.0		99.9	99.9	99.9		97.6					
	5											99.3		99.9							

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 14. Statistical significance values for 48 elements paired with 8 minerals, oil, and water (Continued).

Core	Hole	Analcime		Quartz		Calcite		Dolomite		Na Feld		K Feld		Mg Sider.		Pyrite		Oil		Water	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
H	1										99.8					99.9		99.9	99.9		96.2
	2																	99.9	99.9	98.1	99.9
	3									99.9	99.9	99.9	99.7			99.9	99.0	99.9	99.9	99.7	99.9
	4										98.9					97.6		99.9		98.0	
	5																	99.9			
Hf	1	99.4	99.6	99.7	99.9					98.9	98.9	99.9	99.9	95.8						98.9	99.9
	2				99.4								99.7								
	3			98.9	95.3			96.9		99.9		98.2		99.7		99.8		99.0			
	4									99.9		99.9									
	5	96.0		99.3										99.7						97.5	
Hg	1														96.8			99.9	99.8		
	2										96.5							97.9			
	3									99.2	99.6	98.4				99.6	99.6	97.8	99.9		99.8
	4										97.9		97.1	99.5						98.9	
	5			99.9										99.8						99.6	
K	1			98.3					96.6			99.9	99.9	99.9	99.7						
	2			97.5								99.8	99.9	95.8	98.9						
	3									99.9		99.7	99.9	97.8		99.8		99.9	97.8		
	4	99.3										99.9	99.1	99.9		96.8					
	5											99.9		98.8							
La	1	97.5		99.2						98.2		99.9	99.9	99.9	98.7						
	2			99.4								99.9	99.9		97.8						
	3	98.1	95.5							99.9		96.1		99.0		98.3		98.0			95.3
	4	99.4									97.4	99.9	99.9	99.9	98.2	98.5					
	5			95.9										99.9							
Mg	1			99.2				99.9	99.9												
	2													99.6							
	3			99.9	98.6			99.9	99.9												
	4			98.4				99.9	98.1								95.7				
	5							99.3													

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 14. Statistical significance values for 48 elements paired with 8 minerals, oil, and water (Continued).

Core	Hole	Analcime		Quartz		Calcite		Dolomite		Na Feld		K Feld		Mg Sider.		Pyrite		Oil		Water	
		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Mn	1							95.4			99.9										
	2											98.3	99.5								
	3					99.7															
	4	99.0									99.8	99.9	99.4	99.2	98.1						
	5											97.9		99.9							
Mo	1										97.1				97.4	99.9		99.9	99.9		
	2									99.3	99.8							99.6	99.9	99.8	99.9
	3									99.9	99.4	99.9	98.6	97.5		99.9		99.9	99.9		99.9
	4																	99.8	99.8	99.9	
	5																	99.9			
N	1											99.9	99.9	96.1	99.2	97.5		99.9	99.9		
	2											96.9							97.9		
	3									99.9	99.9	99.9	99.9			99.9	95.8	99.9	99.9	98.6	99.9
	4				95.6						98.5		95.4	95.9		99.9		99.9		99.4	
	5																	99.9			
Na	1	99.9	99.9							99.9	99.9									99.9	99.9
	2	98.8	99.9								99.9								99.9	99.9	99.9
	3		99.3							99.9		99.5				99.8		99.9		95.4	95.2
	4									99.9	99.9	99.8	99.5	97.1	96.0						
	5									99.9											
Nd	1	95.6		96.3						98.9		99.9	99.9	99.9							
	2			99.5								99.9	99.9		95.8						
	3	99.1								99.8				97.0		97.5					
	4	99.6									95.5	99.9	99.9	99.9	99.8	95.7					
	5			97.4										99.9							
Ni	1									99.3	99.9	99.9	99.9	98.8							
	2									96.1					99.5						
	3									99.9	99.9	99.6	99.5	98.6		99.2		99.8	99.9		99.9
	4									97.4	98.0	99.7	99.9	99.9	99.9	99.9				95.6	
	5													99.7							

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 14. Statistical significance values for 48 elements paired with 8 minerals, oil, and water (Continued).

		Analcime		Quartz		Calcite		Dolomite		Na Feld		K Feld		Mg Sider.		Pyrite		Oil		Water	
Core Hole		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Pb	1									99.1	99.9	99.9	99.9								
	2									99.8	97.9				99.3			97.3			
	3									99.9	99.8	99.9	99.1	99.6		99.9		99.9	99.9		99.9
	4	96.3									96.2	99.6	98.5	99.9	98.4	99.9				99.9	
	5									95.5		95.3				97.8					
Rb	1							96.7				99.9	99.9	97.5	97.1						
	2											99.9	99.9	97.9							
	3									99.9		98.5	99.8	99.6		99.9		99.9	97.1		97.5
	4	99.9										99.9	99.1	99.9							
	5											99.9		98.3							
Sb	1										95.2	99.9	99.7	98.8	95.3						
	2				96.1										99.2				97.1		
	3									99.9	97.3			98.8		96.4		99.1			96.2
	4										99.8	96.9	99.2	99.9		99.8		95.6		99.9	
	5											96.4		99.9							
Sc	1									98.1	99.7	99.9	99.9	99.9							
	2			97.9								99.8									
	3									99.9		98.2	97.3	99.2		99.3		98.7			98.2
	4	99.6								96.5		99.9		99.9		97.1					
	5											98.6		99.9							
Se	1														98.5			99.9	99.8		
	2									96.2	99.7							99.9	96.6	97.7	97.3
	3										99.5										
	4										95.6					99.2		99.9	98.5	99.9	
	5																				
Sm	1									99.7		99.9	99.9	99.9	98.5						
	2			99.6	96.4							99.9	99.9								
	3	98.4								99.6				97.6							
	4	99.7									95.5	99.9	99.9	99.9	95.4						
	5			95.0										99.9							

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 14. Statistical significance values for 48 elements paired with 8 minerals, oil, and water (Continued).

		Analcime		Quartz		Calcite		Dolomite		Na Feld		K Feld		Mg Sider.		Pyrite		Oil		Water	
Core	Hole	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Sr	1					99.9	99.9											99.5			
	2	99.9				99.9			97.1										99.9	97.0	96.9
	3					99.9	99.9														
	4					99.9			97.4												
	5					99.9				95.4								97.8			
Ta	1	99.9	99.0		99.9					99.7		99.9	99.9	99.9	99.4						98.9
	2			99.8								99.9	99.9	96.0	98.2						
	3									99.9		98.5	97.5	99.5		99.9		99.8			
	4	99.7								95.5		99.9	99.9	99.7	98.0						
	5											99.4		99.9							
Tb	1									96.9		99.9		99.9							
	2			99.6								99.9	99.8								
	3	97.8	96.7							99.0											
	4	99.8										99.9		99.9							
	5											99.2		99.9							
Th	1	99.8	98.3	99.6	99.8					99.7		99.9		98.9							98.1
	2											99.7									
	3	98.9								99.8		96.3		98.8							
	4	98.1										99.9		98.2		96.6			96.2		
	5																				
Ti	1							97.8				99.9	99.9	99.9							
	2												99.9	99.3	98.6						
	3									99.5		95.7	96.9	98.9		95.3					
	4	97.7									99.9	99.9	98.3	99.8	97.2	98.5					
	5											97.5		99.9							
U	1									98.5						99.9		99.9	99.9		97.3
	2																	99.8	99.9		99.2
	3									99.5				99.8	97.2	99.9		98.5	99.5		95.5
	4											99.9		98.1		98.5				97.4	
	5																				

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 14. Statistical significance values for 48 elements paired with 8 minerals, oil, and water (Continued).

		Analcime		Quartz		Calcite		Dolomite		Na Feld		K Feld		Mg Sider.		Pyrite		Oil		Water	
Core	Hole	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
V	1										99.9	99.9	99.9	99.9		96.3					
	2																				
	3									99.9	99.8	99.9	99.9	98.8		99.9		99.9	99.9	96.7	99.9
	4										99.4	99.9	99.0	99.9		99.9				99.5	
	5			99.7										99.3						99.2	
W	1										99.9										
	2									96.0											
	3									99.9		99.9				99.8		99.9			
	4					96.0					96.0		97.4					95.8			
	5															98.4					
Y	1	98.2								99.9		99.9	99.9	99.4							
	2			99.7								99.9	99.7								
	3	95.0																			
	4	99.9										99.9	99.9	99.3							
	5											99.5		99.9							
Yb	1									99.8		99.9	99.9	99.9	96.0						
	2			99.9	96.8							99.9	95.5								
	3	97.0								99.8				97.3							
	4	99.9									97.5	99.9	99.9	99.9	96.9						
	5											98.3		99.9							
Zn	1									99.9	99.5	99.9	99.9	98.5							
	2												99.9		99.8						
	3									99.9	99.6	99.9	99.6	97.7		99.9		99.9	99.9		99.9
	4	98.3										99.9	99.1	99.9	98.7	99.9				97.1	
	5			99.2										99.9						97.8	
Zr	1	99.9	97.7	97.9	99.9			98.7	99.9			99.2	99.3	98.3						99.9	
	2											99.2	99.9		98.5						
	3			97.6				96.3		95.5											
	4									99.9		99.9									
	5			99.1										99.9						97.0	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 15a. Statistical significance values for 8 minerals, oil, and water paired together.

		Analcime		Quartz		Calcite		Dolomite		Na Feld		K Feld		Mg Sider.		Pyrite		Oil		Water	
Core Hole		15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Analcime	1			99.9	99.9						99.7	(99.9)	(99.9)	(96.8)		(97.7)		(99.4)		99.9	99.9
	2			(99.7)	99.2							(99.9)								99.9	99.9
	3												(98.9)								98.8
	4									(98.9)	(95.7)	95.8	(98.6)	99.5				(99.9)		99.3	96.6
	5			99.9		(97.0)				(99.1)										99.9	
Quartz	1					(99.4)		99.7	99.9		(98.2)	98.9		99.9				(98.1)	(98.0)		98.3
	2					(99.9)						99.9		95.0		96.7				(96.8)	
	3					(96.4)	(99.9)	99.9	99.8											(99.9)	
	4					(99.3)	(97.7)	99.4													
	5					(99.3)				(99.9)		(99.0)								99.9	
Calcite	1							(99.9)	(98.9)		(96.9)	(99.9)	(99.9)	(99.9)							
	2									(99.3)				(96.3)							
	3								(96.1)	(99.9)		(99.2)		(99.8)		(99.9)		(99.9)	(99.0)		(99.6)
	4							(98.5)				(96.6)									
	5							(95.8)				96.4								(99.4)	
Dolomite	1									(97.1)	(99.9)							(99.8)	(99.9)		(95.4)
	2									(96.8)			(98.6)		(99.9)			(98.1)		(96.1)	
	3										(99.8)						(95.8)		(95.7)	(99.9)	
	4										(95.2)		(97.8)	(96.3)		(95.5)		(98.8)		(99.9)	
	5													(95.7)							
Na Feld	1																		97.1		99.3
	2																				99.9
	3											99.9	98.3			99.9		99.9	99.9		
	4																		(95.0)	(99.4)	
	5															99.0				(99.9)	
K Feld	1													99.9	99.9		99.9			(99.9)	(99.8)
	2																	(97.5)	(99.9)	(96.4)	(98.9)
	3															98.7		99.9	99.6		
	4													98.6	95.8			(97.1)			(95.1)
	5																	(99.4)		(99.9)	

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 15b. Statistical significance values for 8 minerals, oil, and water paired together (Continued).

	Analcime		Quartz		Calcite		Dolomite		Na Feld		K Feld		Mg Sider.		Pyrite		Oil		Water	
Core Hole	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25	15/16	25
Mg Sider 1																		95.3	(99.8)	(98.0)
2																		(96.5)		
3																				
4															98.3				99.9	
5																	(98.3)			
Pyrite 1																	99.9			
2																				
3																		98.9		98.6
4																			98.1	
5																	98.0			
Oil 1																				
2																			98.2	99.9
3																			97.8	99.9
4																				
5																				

Group 1. Overlying oil shale
2. Upper Mahogany Zone
3. Mahogany Bed
4. Lower Mahogany Zone
5. Rich oil shale

Table 16. Average element content and standard deviation for stratigraphic zones in core hole 15/16.[a]

Element	Overlying Oil Shale			Upper Mahogany Zone			Mahogany Bed			Lower Mahogany Zone			Rich Oil Shale		
	Average Value	Standard Deviation	Number of Value	Average Value	Standard Deviation	Number of Value	Average Value	Standard Deviation	Number of Value	Average Value	Standard Deviation	Number of Value	Average Value	Standard Deviation	Number of Value
Al%	3.55	0.66	70	3.68	0.64	18	2.71	0.52	26	3.52	.97	36	4.03	1.15	17
As	39.6	11.0	70	43.2	16.0	18	71.5	30.1	26	37.1	18.3	36	13.6	5.8	17
B	77	35	70	73	24	18	86	29	26	48	20	36	101	69	17
Ba	504	40	70	530	71	18	421	106	26	520	76	36	598	194	17
C(min)%	5.55	0.70	70	4.95	0.66	18	4.72	1.68	26	5.38	1.00	36	5.28	.94	17
C(org)%	7.05	2.05	70	10.80	4.23	18	18.69	6.67	26	10.54	4.82	36	7.95	3.11	17
Ca%	12.2	2.3	70	9.9	2.1	18	12.2	4.8	26	11.9	2.8	36	10.3	2.8	17
Cd	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0
Ce	38.6	6.3	70	42.2	6.9	18	30.2	6.0	26	38.6	9.8	36	42.9	8.0	17
Co	8.37	1.32	70	8.89	1.81	18	9.00	2.78	26	8.46	2.27	36	9.27	1.60	17
Cr	32.5	5.7	70	34.6	5.4	18	28.8	5.6	26	33.2	8.8	36	40.6	8.3	17
Cs	4.76	1.33	70	5.10	2.69	18	3.76	1.11	26	4.39	1.83	36	4.10	1.18	17
Cu	28.4	5.6	70	32.6	6.3	18	33.2	15.2	26	30.4	11.1	36	27.5	7.7	17
Dy	2.13	0.35	66	2.36	0.65	18	1.56	0.28	26	2.11	0.61	36	2.33	0.46	17
Eu	0.573	0.090	70	0.623	0.100	18	0.447	0.077	26	0.580	0.140	36	0.643	0.126	17
F%	0.125	0.055	70	0.167	0.067	18	0.096	0.035	26	0.126	0.058	36	0.211	0.061	17
Fe%	1.97	0.38	70	2.04	0.31	18	1.59	0.38	16	1.95	0.55	36	2.29	0.46	17
Ga	8.8	1.8	70	8.9	2.0	18	6.2	1.5	26	8.3	2.5	36	9.8	2.7	17
H%	1.03	0.25	70	1.53	0.52	18	2.49	0.83	26	1.38	0.61	36	1.02	0.41	17
Hg	0.070	0.022	70	0.072	0.040	18	0.112	0.041	26	0.087	0.079	36	0.041	0.014	17
Hf	1.63	0.25	70	1.73	0.16	18	1.30	0.30	26	1.46	0.35	36	1.77	0.35	17
K%	1.77	0.74	70	1.75	0.84	18	0.96	0.17	26	1.52	0.58	36	2.27	1.25	17
La	19.1	3.2	70	20.7	3.5	18	15.3	3.3	26	19.3	4.9	36	21.5	3.8	17
Lu	0.169	0.033	70	0.190	0.065	18	0.121	0.028	26	0.167	0.049	36	0.174	0.033	17
Mg%	3.56	0.69	70	3.79	0.98	18	2.82	0.68	26	3.54	0.84	36	4.19	0.85	17
Mn	366	48	70	312	50	18	268	36	26	272	35	36	286	60	17
Mo	13.6	4.4	70	23.6	12.6	18	25.0	11.1	26	23.4	7.0	36	21.8	7.3	17
N%	0.44	0.15	70	0.52	0.14	18	0.74	0.24	26	0.55	0.17	36	0.40	0.13	17
Na%	1.43	0.44	70	1.60	0.42	18	1.39	0.29	26	1.66	0.41	36	1.76	0.56	17
Nd	16.3	2.8	70	18.2	3.1	18	12.1	2.5	26	16.0	4.4	36	18.0	3.7	17
Ni	20.2	2.9	70	20.0	2.7	18	20.5	4.5	26	19.7	4.8	36	21.3	3.7	17
Pb	18.0	5.1	70	21.3	6.0	18	21.5	11.7	26	20.0	9.3	36	19.1	4.9	17
Rb	69.6	13.1	70	73.4	13.6	18	51.7	10.5	26	69.2	14.1	36	84.1	13.5	17
Sb	1.45	0.30	70	1.87	0.53	18	2.31	1.18	26	1.51	0.71	36	0.92	0.40	17
Sc	5.96	1.16	70	6.16	1.20	18	4.43	0.86	26	5.75	1.64	36	6.71	1.81	17
Se	1.67	0.49	70	1.97	0.89	18	3.43	0.98	25	1.85	0.88	36	1.16	0.45	17
Sm	2.74	0.44	70	3.01	0.60	18	2.08	0.37	26	2.77	0.72	36	3.05	0.61	17
Sr	724	133	70	693	126	18	745	338	26	865	231	36	778	245	17
Ta	0.448	0.085	70	0.468	0.080	18	0.325	0.052	26	0.418	0.099	36	0.488	0.105	17
Tb	0.334	0.060	70	0.353	0.100	18	0.240	0.045	25	0.332	0.103	36	0.362	0.078	17
Th	6.28	1.21	70	6.74	1.24	18	4.27	0.82	26	6.10	1.77	36	6.35	1.32	17
Ti%	0.150	0.035	70	0.160	0.039	18	0.099	0.038	26	0.135	0.039	36	0.169	0.056	17
U	3.40	0.70	70	4.40	0.90	18	3.63	1.42	26	4.25	1.21	36	4.46	0.92	17
V	81	19	70	103	23	18	112	43	26	97	30	36	103	24	17
W	1.44	0.66	69	1.64	0.54	18	3.33	2.24	26	1.76	0.84	36	1.16	0.37	17
Y	11.2	2.5	70	11.6	4.7	18	5.8	1.8	26	10.5	4.2	36	12.1	3.4	17
Yb	1.22	0.21	70	1.38	0.42	18	0.87	0.16	25	1.20	0.36	36	1.32	0.28	17
Zn	66.0	14.9	70	84.9	12.1	18	67.3	15.3	26	68.6	15.4	36	82.0	22.0	17
Zr	40.9	8.5	70	38.1	10.9	18	26.2	8.5	26	32.7	12.0	36	47.5	13.9	17

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[a] All concentrations are in μg/g unless otherwise indicated.

Table 17. Average element content and standard deviation for stratigraphic zones in core hole 25.[a]

Element	Overlying Oil Shale			Upper Mahogany Zone			Mahogany Bed			Lower Mahogany Zone		
	Average Value	Standard Deviation	Number of Value	Average Value	Standard Deviation	Number of Value	Average Value	Standard Deviation	Number of Value	Average Value	Standard Deviation	Number of Value
Al%	3.50	0.59	49	4.47	1.03	18	3.10	0.52	20	3.35	0.74	7
As	34.2	8.9	49	33.3	16.5	18	56.6	26.3	20	39.3	24.8	7
B	86	21	49	109	47	18	59	21	20	51	4	7
Ba	519	44	49	508	101	18	415	69	20	449	39	7
C(min)%	5.56	.69	49	4.37	0.78	18	4.32	1.41	20	4.94	1.09	7
C(org)%	6.85	1.94	48	8.00	4.41	18	16.98	5.98	19	11.90	3.78	7
Ca%	12.8	2.2	49	8.8	2.7	18	10.0	3.1	20	11.0	1.9	7
Cd	0.46	0.18	49	0.73	0.13	18	0.79	0.26	20	0.83	0.21	7
Ce	38.7	5.6	49	46.3	7.7	18	35.2	5.9	20	37.6	8.5	7
Co	7.73	1.49	49	9.21	1.45	18	9.04	2.45	20	8.29	2.15	7
Cr	32.0	7.4	49	40.4	8.0	18	30.7	5.7	20	31.1	8.5	7
Cs	4.76	0.66	49	4.85	0.66	18	3.83	0.88	20	4.40	0.59	7
Cu	27.1	6.4	49	32.5	5.0	18	37.4	12.6	20	31.7	8.8	7
Dy	2.11	0.30	49	2.73	0.71	18	1.84	0.35	20	2.05	0.46	7
Eu	0.562	0.081	49	0.718	0.121	18	0.524	0.092	20	0.562	0.132	7
F%	0.124	0.037	49	0.149	0.053	18	0.123	0.064	20	0.080	0.070	6
Fe%	1.95	0.38	49	2.31	0.44	18	1.79	0.35	20	1.97	0.44	7
Ga	8.2	1.6	49	10.6	2.5	18	7.3	1.1	20	7.9	1.9	7
H%	1.07	0.25	48	1.26	0.56	18	2.24	0.74	20	1.43	0.59	7
Hg	0.053	0.020	49	0.061	0.019	18	0.091	0.044	20	0.079	0.037	7
Hf	1.70	0.29	49	2.19	0.38	18	1.61	0.25	20	1.99	0.76	7
K%	1.79	0.66	49	2.77	1.65	18	1.34	0.49	20	1.59	0.55	7
La	19.0	2.8	49	23.9	4.5	18	17.4	3.1	20	18.2	3.7	7
Lu	0.160	0.024	49	0.217	0.055	18	0.147	0.029	20	0.157	0.024	7
Mg%	3.74	0.62	49	3.40	0.85	18	3.31	0.93	20	3.84	0.74	7
Mn	361	42	49	342	50	18	282	40	20	287	31	7
Mo	14.4	5.0	49	19.0	11.1	18	28.2	9.9	20	19.3	4.4	7
N%	0.41	0.14	49	0.51	0.09	18	0.66	0.23	20	0.47	0.15	7
Na%	1.36	0.38	49	1.32	0.71	18	1.68	0.27	20	1.57	0.22	7
Nd	16.4	2.7	49	20.0	3.8	18	14.0	2.7	20	16.8	2.8	7
Ni	19.4	3.1	49	22.6	2.6	18	22.8	4.2	20	21.6	4.5	7
Pb	18.3	5.1	49	21.4	5.2	18	24.2	10.0	20	19.6	6.5	7
Rb	69.9	12.5	49	89.9	28.9	18	63.6	10.5	20	69.5	8.1	7
Sb	1.39	0.33	49	1.69	0.33	18	2.28	0.83	20	1.76	0.76	7
Sc	5.83	1.11	49	6.95	1.28	18	5.21	0.76	20	5.98	1.10	7
Se	1.39	0.42	49	1.42	0.47	18	2.12	0.81	20	1.51	0.86	7
Sm	2.68	0.38	49	3.45	0.68	18	2.47	0.44	20	2.66	0.59	7
Sr	758	138	49	609	160	18	632	212	20	707	157	7
Ta	0.445	0.078	49	0.565	0.129	18	0.375	0.057	20	0.420	0.085	7
Tb	0.334	0.053	49	0.430	0.112	18	0.288	0.057	20	0.353	0.080	7
Th	6.11	1.12	49	6.92	1.25	18	4.89	0.85	20	6.11	1.18	7
Ti%	0.130	0.032	49	0.182	0.050	18	0.130	0.023	20	0.118	0.024	7
U	3.53	0.94	49	4.09	1.04	18	3.88	0.80	20	4.54	1.00	7
V	81	16	49	107	19	18	116	31	20	102	30	7
W	1.07	0.37	49	1.13	0.30	18	1.45	0.50	20	1.47	0.70	7
Y	10.9	1.8	49	14.8	4.9	18	7.9	2.4	20	9.7	2.6	7
Yb	1.19	0.19	49	1.54	0.36	18	1.04	0.20	20	1.17	0.25	7
Zn	64.2	10.7	49	80.3	12.9	18	68.2	12.6	20	67.0	11.6	7
Zr	48.1	8.4	49	58.8	15.6	18	40.1	11.1	20	68.6	67.8	7

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[a] All concentration values are in µg/g unless otherwise indicated.

Table A-1. Oil shale assays by modified Fischer Retort Method, core hole 15/16.

OIL SHALE ASSAYS BY MODIFIED FISCHER RETORT METHOD

SAMPLE ID	OIL PERC	WATER PERC	SPENT SHALE PERC	GAS + LOSS PERC	OIL GAL/T	WATER GAL/T	SPEC.GRAV. OF OIL AT 60 DEG. F	SPENT SHALE TENDENCY TO COKE
CCS- 860	5.60	1.65	91.30	1.45	14.30	3.95	.940	NONE
CCS- 865	3.35	1.45	94.10	1.10	8.40	3.50	.950	NONE
CCS- 870	3.70	1.40	93.75	1.15	9.40	3.35	.946	NONE
CCS- 875	3.30	.65	95.30	.75	8.45	1.55	.939	NONE
CCS- 880	2.60	1.30	95.30	.80	6.60	3.15	.944	NONE
CCS- 885	5.10	1.40	92.00	1.50	12.90	3.40	.947	NONE
CCS- 890	4.85	1.20	92.80	1.15	12.40	2.90	.940	NONE
CCS- 895	3.50	1.10	94.25	1.15	8.90	2.65	.945	NONE
CCS- 900	4.65	1.30	92.70	1.35	11.95	3.15	.930	NONE
CCS- 905	5.90	1.50	91.10	1.50	15.10	3.60	.934	NONE
CCS- 910	3.30	1.70	94.10	.90	8.40	4.10	.949	NONE
CCS- 915	5.30	1.50	91.90	1.30	13.55	3.60	.938	NONE
CCS- 920	5.75	1.95	90.95	1.35	14.85	4.70	.928	NONE
CCS- 925	5.70	1.55	91.50	1.25	14.55	3.70	.937	NONE
CCS- 930	5.30	1.40	91.75	1.55	13.45	3.35	.945	NONE
CCS- 935	6.40	1.45	90.35	1.80	16.45	3.50	.933	NONE
CCS- 940	5.55	1.45	91.40	1.60	14.05	3.45	.942	NONE
CCS- 945	5.60	1.10	91.95	1.35	14.35	2.65	.939	NONE
CCS- 950	5.90	1.40	91.35	1.35	15.05	3.35	.939	NONE
CCS- 955	5.90	1.45	91.00	1.65	15.20	3.50	.928	NONE
CCS- 960	5.30	1.25	91.60	1.85	13.75	3.00	.922	NONE
CCS- 965	6.30	1.70	90.25	1.75	16.40	4.05	.925	NONE
CCS- 970	8.80	1.40	87.50	2.30	22.80	3.40	.921	NONE
CCS- 975	9.20	1.40	86.65	2.75	23.85	3.35	.921	NONE
CCS- 980	6.00	1.10	91.35	1.55	15.75	2.60	.916	NONE
CCS- 985	5.30	1.60	91.65	1.45	13.60	3.85	.925	NONE
CCS- 990	5.90	1.45	90.65	2.00	15.25	3.50	.925	NONE
CCS- 995	4.50	1.50	92.40	1.60	11.65	3.60	.927	NONE
CCS-1000	4.30	1.75	92.50	1.45	11.10	4.20	.928	NONE
CCS-1005	3.30	1.95	93.55	1.20	8.55	4.70	.930	NONE
CCS-1010	7.55	1.45	89.05	1.95	19.70	3.50	.921	NONE
CCS-1015	3.80	1.80	92.90	1.50	9.85	4.30	.928	NONE
CCS-1020	6.00	1.30	90.90	1.80	15.40	3.15	.929	NONE
CCS-1025	3.85	1.60	93.40	1.15	9.80	3.80	.937	NONE
CCS-1030	7.50	1.20	89.30	2.00	19.35	2.90	.928	NONE
CCS-1035	4.90	1.20	92.40	1.50	12.80	2.90	.924	NONE
CCS-1040	9.15	1.45	87.20	2.20	23.70	3.50	.927	NONE
CCS-1045	3.55	1.10	94.30	1.05	9.00	2.60	.939	NONE
CCS-1050	5.40	1.75	90.75	2.10	13.75	4.20	.937	NONE
CCS-1055	5.15	1.65	91.95	1.25	13.20	3.95	.933	NONE
CCS-1060	8.75	1.30	87.40	2.55	22.65	3.10	.925	NONE
CCS-1065	4.75	.50	93.55	1.20	12.50	1.20	.917	NONE
CCS-1070	6.30	.75	91.60	1.35	16.20	1.80	.925	NONE
CCS-1075	6.10	1.15	91.35	1.40	15.65	2.75	.933	NONE
CCS-1080	5.10	.30	93.20	1.40	13.25	.70	.920	NONE
CCS-1085	6.20	1.50	90.60	1.70	16.00	3.60	.936	NONE
CCS-1090	4.80	1.55	92.00	1.65	12.20	3.70	.941	NONE
CCS-1095	5.00	.85	92.75	1.40	12.75	2.05	.937	NONE

Table A-1. Oil shale assays by modified Fischer Retort Method, core hole 15/16 (continued).

SAMPLE ID	OIL PERC	WATER PERC	SPENT SHALE PERC	GAS + LOSS PERC	OIL GAL/T	WATER GAL/T	SPEC.GRAV. OF OIL AT 60 DEG. F	SPENT SHALE TENDENCY TO COKE
CCS-1100	4.50	1.55	92.75	1.20	11.50	3.70	.941	NONE
CCS-1105	5.40	1.30	91.75	1.55	13.80	3.15	.939	NONE
CCS-1110	5.65	1.25	91.40	1.70	14.45	3.00	.937	NONE
CCS-1115	6.25	1.20	90.95	1.60	16.05	2.90	.932	NONE
CCS-1120	5.60	.70	92.15	1.55	14.45	1.65	.926	NONE
CCS-1125	6.35	1.40	90.85	1.40	16.35	3.35	.932	NONE
CCS-1130	4.45	.70	93.60	1.25	11.55	1.70	.926	NONE
CCS-1135	5.20	2.00	91.40	1.40	13.40	4.80	.933	NONE
CCS-1140	5.15	1.20	92.15	1.50	13.25	2.85	.937	NONE
CCS-1145	7.40	1.15	89.60	1.85	19.05	2.75	.933	NONE
CCS-1150	7.80	1.00	89.40	1.80	20.15	2.40	.929	NONE
CCS-1155	4.35	1.35	93.15	1.15	11.10	3.25	.942	NONE
CCS-1160	5.85	1.45	91.40	1.30	15.05	3.50	.935	NONE
CCS-1165	3.60	1.65	93.55	1.20	9.25	3.95	.935	NONE
CCS-1170	7.10	1.45	89.65	1.80	18.40	3.50	.926	NONE
CCS-1175	6.50	1.55	90.25	1.70	16.80	3.70	.926	NONE
CCS-1180	7.50	1.00	89.70	1.80	19.45	2.40	.923	NONE
CCS-1185	6.50	1.30	90.40	1.80	16.90	3.10	.925	NONE
CCS-1190	9.85	1.40	86.05	2.70	25.75	3.55	.919	NONE
CCS-1196	6.65	.95	90.35	2.05	17.35	2.30	.920	NONE
CCS-1205	2.90	.60	95.05	.95	7.65	1.40	.913	NONE
CCS-1208	3.40	.70	94.65	1.25	9.10	1.70	.905	NONE
MZ-1210	6.15	.70	91.60	1.55	16.30	1.70	.903	NONE
MZ-1212	6.15	1.45	90.25	2.15	16.15	3.60	.909	NONE
MZ-1214	11.45	1.60	83.95	3.00	30.05	3.80	.912	NONE
MZ-1216	7.40	1.55	88.45	2.60	19.35	3.70	.919	NONE
MZ-1218	6.90	1.75	88.35	3.00	18.00	4.20	.917	NONE
MZ-1220	11.30	1.80	83.40	3.50	29.40	4.30	.922	NONE
MZ-1222	9.60	1.50	86.20	2.70	25.15	3.60	.914	NONE
MZ-1224	17.20	1.70	77.45	3.65	45.60	4.05	.904	MODERATE
MZ-1226	12.05	1.45	84.05	2.45	32.15	3.50	.897	NONE
MZ-1228	9.15	1.40	86.65	2.80	24.10	3.35	.912	NONE
MZ-1230	6.45	1.75	90.00	1.80	16.70	4.20	.924	NONE
MZ-1232	8.60	1.40	87.95	2.05	22.35	3.40	.918	NONE
MZ-1234	4.75	1.15	91.85	2.25	12.35	2.75	.921	NONE
MZ-1236	4.30	.85	92.85	2.00	11.20	2.05	.917	NONE
MZ-1238	3.95	.85	93.80	1.40	10.40	2.05	.913	NONE
MZ-1240	12.10	1.55	83.20	3.15	31.55	3.70	.921	NONE
MZ-1242	9.20	1.40	86.90	2.50	24.25	3.40	.913	NONE
MZ-1244	11.90	1.00	84.25	2.85	31.35	2.40	.912	NONE
ME-1245	15.15	1.25	79.40	4.20	39.50	3.00	.920	SLIGHT
ME-1246	13.25	1.15	82.20	3.40	34.70	2.75	.916	NONE
ME-1247	13.55	.95	82.60	2.90	35.75	2.30	.910	NONE
ME-1248	15.50	1.30	78.90	4.30	40.95	3.10	.908	NONE
ME-1249	26.00	1.60	66.30	6.10	68.30	3.80	.913	HEAVY
ME-1250	28.55	1.70	63.50	6.25	75.65	4.10	.905	HEAVY
ME-1251	26.25	1.45	66.25	6.05	69.20	3.50	.910	HEAVY
ME-1252	22.75	1.25	70.80	5.20	59.85	3.00	.911	MODERATE

Table A-1. Oil shale assays by modified Fischer Retort Method, core hole 15/16 (continued).

SAMPLE ID	OIL PERC	WATER PERC	SPENT SHALE PERC	GAS + LOSS PERC	OIL GAL/T	WATER GAL/T	SPEC.GRAV. OF OIL AT 60 DEG. F	SPENT SHALE TENDENCY TO COKE
ME-1253	19.00	1.20	75.60	4.20	49.70	2.90	.916	SLIGHT
ME-1254	16.15	1.05	79.05	3.75	42.50	2.50	.911	SLIGHT
ME-1255	14.10	1.05	81.20	3.65	36.85	2.50	.919	NONE
ME-1256	10.30	1.20	85.75	2.75	26.75	2.90	.922	NONE
ME-1257	11.70	1.05	84.35	2.90	30.70	2.50	.913	NONE
ME-1258	15.15	1.00	80.75	3.10	39.70	2.40	.916	NONE
ME-1259	13.10	.90	83.35	2.65	34.50	2.20	.911	NONE
ME-1260	11.90	1.15	83.65	3.30	30.90	2.75	.922	NONE
ME-1261	17.80	1.00	76.50	4.70	47.10	2.40	.905	SLIGHT
ME-1262	16.55	1.05	78.45	3.95	43.65	2.50	.910	NONE
ME-1263	9.25	.70	87.75	2.30	24.25	1.70	.914	NONE
ME-1264	8.60	1.05	88.05	2.30	22.50	2.50	.915	NONE
ME-1265	8.45	1.20	88.05	2.30	21.95	2.90	.921	NONE
ME-1266	9.90	1.20	86.15	2.75	25.75	2.90	.921	NONE
ME-1267	8.10	1.30	88.30	2.30	21.10	3.10	.921	NONE
ME-1268	9.40	1.40	86.70	2.55	24.35	3.35	.921	NONE
ME-1269	9.65	1.40	86.00	2.95	25.10	3.35	.922	NONE
ME-1270	8.40	1.25	87.95	2.40	22.10	3.00	.917	NONE
MZ-1272	16.55	1.20	78.60	3.65	43.55	2.90	.912	NONE
MZ-1274	9.20	1.25	85.25	4.30	24.90	3.00	.890	NONE
MZ-1276		.85	80.15	3.90	40.35	2.05	.898	NONE
MZ-1278	8.65	.95	88.10	2.30	22.95	2.30	.905	NONE
MZ-1280	8.95	.90	87.55	2.60	23.75	2.20	.909	NONE
MZ-1282	12.85	1.05	82.50	3.60	33.55	2.50	.921	NONE
MZ-1284	6.60	1.15	90.20	2.05	17.30	2.75	.914	NONE
MZ-1286	9.15	.80	87.80	2.25	24.30	1.90	.903	NONE
MZ-1288	15.75	.80	79.95	3.50	42.10	1.90	.898	NONE
MZ-1289	13.35	.85	82.90	2.90	35.75	2.05	.896	NONE
MZ-1292	13.00	1.00	82.85	3.15	33.95	2.40	.919	SLIGHT
MZ-1295	15.90	1.00	79.70	3.40	42.15	2.40	.904	NONE
MZ-1300	11.20	.85	85.35	2.60	29.55	2.05	.909	NONE
MZ-1302	6.10	.75	91.10	2.05	15.85	1.80	.917	NONE
MZ-1304	8.15	.50	89.10	2.25	21.25	1.20	.919	NONE
MZ-1306	6.85	1.40	89.50	2.25	17.75	3.35	.922	NONE
MZ-1308	5.00	1.00	92.50	1.50	13.05	2.40	.917	NONE
MZ-1310	7.05	.95	89.60	2.40	18.55	2.30	.907	NONE
MZ-1312	5.90	1.25	90.40	2.40	15.85	3.00	.900	NONE
MZ-1314	4.25	1.50	91.65	2.60	11.10	3.60	.913	NONE
MZ-1316	8.20	1.30	88.30	2.20	21.30	3.10	.922	NONE
MZ-1318	5.00	1.30	91.85	1.85	13.15	3.10	.915	NONE
MZ-1320	12.60	1.15	82.85	3.40	32.80	2.75	.922	NONE
MZ-1322	9.45	1.20	87.00	2.35	24.75	2.90	.916	NONE
MZ-1324	4.65	1.05	93.15	1.15	12.20	2.50	.915	NONE
MZ-1326	2.70	.75	95.75	.80	6.95	1.80	.919	NONE
MZ-1328	7.45	1.00	89.75	1.80	19.45	2.40	.917	NONE
MZ-1330	12.95	1.05	82.85	3.15	33.90	2.50	.914	NONE
MZ-1332	11.75	.90	84.50	2.85	31.00	2.15	.912	NONE
MZ-1334	6.05	.80	91.55	1.60	15.85	1.90	.913	NONE

Table A-1. Oil shale assays by modified Fischer Retort Method, core hole 15/16 (continued).

SAMPLE ID	OIL PERC	WATER PERC	SPENT SHALE PERC	GAS + LOSS PERC	OIL GAL/T	WATER GAL/T	SPEC.GRAV. OF OIL AT 60 DEG. F	SPENT SHALE TENDENCY TO COKE
MZ-1336	5.50	.70	92.60	1.20	14.40	1.70	.914	NONE
MZ-1338	3.35	.45	95.20	1.00	8.80	1.10	.921	NONE
MZ-1340	3.60	.30	95.00	1.10	9.40	.70	.920	NONE
MZ-1342	4.05	.35	94.40	1.20	10.55	.85	.919	NONE
MZ-1344	4.40	.40	93.90	1.30	11.50	1.00	.914	NONE
MZ-1346	4.60	.80	93.40	1.20	12.05	1.90	.914	NONE
BC-1372	1.20	.40	97.95	.45	3.15	1.00		NONE
RCS-1377	1.30	.40	97.55	.75	3.35	1.00		NONE
RCS-1382	4.45	.80	92.60	2.15	11.70	1.90	.911	NONE
RCS-1387	11.65	1.25	83.85	3.05	31.10	3.00	.914	NONE
RCS-1392	4.20	1.30	93.00	1.50	10.85	3.10	.928	NONE
RCS-1397	6.45	.70	90.65	2.20	17.15	1.70	.898	NONE
RCS-1402	8.55	.85	88.00	2.60	22.80	2.05	.900	SLIGHT
RCS-1407	5.55	.90	90.30	2.85	15.70	2.15	.909	NONE
RCS-1412	7.85	.60	89.05	2.50	20.50	1.40	.914	SLIGHT
RCS-1417	8.20	.55	88.90	2.35	21.75	1.30	.902	NONE
RCS-1422	6.25	.60	91.50	1.65	16.50	1.40	.907	NONE
RCS-1426	4.25	.35	93.85	1.50	11.15	1.00	.918	NONE
RCS-1445	10.20	1.95	85.15	2.70	26.55	4.70	.919	NONE
RCS-1450	7.10	1.90	88.60	2.40	18.55	4.60	.913	NONE
RCS-1455	5.20	2.15	90.90	1.75	13.55	5.15	.916	NONE
RCS-1460	7.20	2.35	88.55	1.90	18.80	5.65	.913	NONE
RCS-1465	6.50	2.15	89.35	2.00	17.10	5.15	.911	NONE
RCS-1468	2.45	1.50	94.45	1.60	6.40	3.60	.921	NONE
PCS-1518	3.45	2.25	92.35	1.95	9.05	5.40	.917	NONE
PCS-1568	2.15	2.30	94.10	1.45	5.65	5.55	.907	NONE
PCS-1618	4.25	1.95	91.95	1.85	11.20	4.65	.914	NONE
PCS-1668	1.30	1.60	96.40	.70	3.40	3.80		NONE
PCS-1718	1.35	1.65	96.25	.75	3.55	3.95		NONE
PCS-1768	3.10	2.05	93.85	1.00	8.15	4.95	.912	NONE
PCS-1818	4.05	1.75	92.95	1.25	10.65	4.20	.909	NONE
PCS-1868	3.60	2.20	92.85	1.35	9.50	5.25	.909	NONE
PCS-1918	1.10	2.05	95.75	1.10	2.85	4.95		NONE
PCS-1968	2.45	2.50	94.00	1.05	6.55	6.00	.902	NONE
PCS-2019	2.30	2.35	94.50	.85	6.15	5.65	.896	NONE

Table A-2. X-ray diffraction results, core hole 15/16.

SAMPLE ID	ANALCIME	QUARTZ	CALCITE	DOLOMITE	NA FELDSPAR	K FELDSPAR	MAGN.SID.	PYRITE	ILLITE	ARAGONITE	DAWSONITE	FLUORITE
	(........ESTIMATED PERCENT........)				(.................................PEAK HEIGHT.................................)							
CCS- 860	7	8	6	30	19	12		4	2			
CCS- 865	7	8	6	31	30	20	5					
CCS- 870	7	9	7	32	31	19	3	3				
CCS- 875	3	10	5	36	23	27	4					
CCS- 880	6	10	1	33	32	32	3	4				
CCS- 885	7	8	8	27	27	18	3	4				
CCS- 890	7	11	6	31	43	19	5	4				
CCS- 895	6	9	9	33	32	25	4					
CCS- 900	8	10	6	34	37	21		6				
CCS- 905	7	10	3	35	20	22	3	5	3			
CCS- 910	8	8	4	40	25	23	4	4	2			
CCS- 915	6	9	6	37	17	21	5	6				
CCS- 920	9	10	2	40	21	18	4	3	4			
CCS- 925	6	8	4	37	16	26	5	6				
CCS- 930	6	8	9	34	18	18	3					
CCS- 935	5	7	7	29	15	21	5					
CCS- 940	6	8	11	29	13	12	3	3				
CCS- 945	5	9	13	31	8	8						
CCS- 950	6	10	13	36	10	9			2			
CCS- 955	6	9	8	34	16	14	4	6				
CCS- 960	5	9	5	35	27	29	4	5				
CCS- 965	7	10	5	39	18	12		5				
CCS- 970	4	9	6	35	31	22	3	5				
CCS- 975	5	8	5	26	21	21	6	6				
CCS- 980	4	7	2	31	18	32	7	6				
CCS- 985	7	9	5	31	19	20	5	4	3			
CCS- 990	6	9	4	31	24	25	4	6				
CCS- 995	6	9	2	36	18	27	6	6	3			
CCS-1000	9	10	2	36	16	17	4					
CCS-1005	8	10	1	34	20	20	8		3			
CCS-1010	4	9	2	36	18	27	5	7	3			
CCS-1015	7	9		35	21	24	7	4	3			
CCS-1020	7	10	6	36	16	16	5		3			
CCS-1025	9	10	3	40	18	15						
CCS-1030	4	10	3	38	16	25	4	3				
CCS-1035	4	9	1	33	21	34	9	6	3			
CCS-1040	6	9	9	28	21	18	6		3			
CCS-1045	5	10	4	42	17	27	5					
CCS-1050	10	10	7	37	30	16	3					
CCS-1055	8	10	4	33	21	19	4					
CCS-1060	5	9	5	32	28	32	5	6				
CCS-1065		9	5	37	17	39	7	7				
CCS-1070		11	1	40	13	37	7	5				
CCS-1075	5	10	4	34	9	26	5					
CCS-1080		10	2	35	14	43	7	3				
CCS-1085	9	12	3	36	13	25	5					
CCS-1090	10	9	6	35	13	16	3	4				
CCS-1095	4	10	8	39	10	16	3	3				

Table A-2. X-ray diffraction results, core hole 15/16 (continued).

SAMPLE ID	ANALCIME	QUARTZ	CALCITE	DOLOMITE	NA FELDSPAR	K FELDSPAR	MAGN.SID.	PYRITE	ILLITE	ARAGONITE	DAWSONITE	FLUORITE
	(.........ESTIMATED PERCENT			........)	(..................................			PEAK HEIGHT	....			
CCS-1100	8	10	7	33	13	10	2					
CCS-1105	7	10	8	33	11	12	2	6				
CCS-1110	7	10	5	34	14	16						
CCS-1115	5	8	7	28	15	17	4	4				
CCS-1120	3	9	5	35	12	23	4	5				
CCS-1125	6	8	6	30	15	13	4	5		15		
CCS-1130	5	10	7	41	9	18						
CCS-1135	14	11	6	29	19	14						
CCS-1140	5	8	9	32	11	13	2	7				
CCS-1145	3	8	10	28	21	16	2	6				
CCS-1150	3	7	6	29	26	22	6	5				
CCS-1155	7	8	5	35	13	13		4				
CCS-1160	7	9	6	33	15	9	3					
CCS-1165	8	10	1	43	9	14	3					
CCS-1170	8	9	6	35	16	14	3	4	3			
CCS-1175	6	9	4	37	17	18		4	4			
CCS-1180	4	8	8	31	12	22	5					
CCS-1185	6	9	6	36	20	15		5				
CCS-1190	6	10	5	30	21	14	6	12				
CCS-1156	3	9	3	32	22	29	7	8				
CCS-1205		10		36	14	48	19					
CCS-1208		13		27	15	61	37	3				
MZ-1210	7	11		37	31	15	29		3			
MZ-1212	7	12		37	28	15	29		5			
MZ-1214	7	9		26	38	21	14	8	4		2	
MZ-1216	7	8		29	25	20	11	6	3			
MZ-1218	5	11		36	28	15	17				3	
MZ-1220	6	12	1	21	56	28	14	5			2	
MZ-1222	7	8	4	29	21	13		6		19		
MZ-1224	7	11	2	27	24	18	11	7	4		1	
MZ-1226	8	10	3	31	22	17	5	7	4	26	1	
MZ-1228	7	8	3	30	20	22	7	6	3	3C		
MZ-1230	9	10	3	37	22	18		8	5	21		
MZ-1232	8	10	3	40	18	18	2		4	20	1	
MZ-1234	4	16		36	18	35		17			3	
MZ-1236	2	14		32	22	47	21	6	3		3	
MZ-1238	3	12		34	17	37	8	4	2		1	
MZ-1240	6	11	2	32	21	19	8		5			
MZ-1242	7	9	3	32	28	17		9	3			
MZ-1244	4	11	1	38	40	15	7					
ME-1245	5	9	3	34	54	13	9	8				
ME-1246	6	8	8	28	47	12	5	8				
ME-1247	2	10	10	32	25	16	4	6				
ME-1248	4	9	1	26	53	17	7	14			1	
ME-1249	4	9	1	22	49	23	9	13				
ME-1250	4	8	2	22	57	20	6	13				
ME-1251	2	7	2	22	85	21	3	12				
ME-1252	2	7	1	26	96	29	5	10				

Table A-2. X-ray diffraction results, core hole 15/16 (continued).

SAMPLE ID	ANALCIME	QUARTZ	CALCITE	DOLOMITE	NA FELDSPAR	K FELDSPAR	MAGN.SID.	PYRITE	ILLITE	ARAGONITE	DAWSONITE	FLUORITE
	(........ESTIMATED PERCENT........)				(........PEAK HEIGHT........)							
ME-1253	3	8	4	24	58	13	6	12				
ME-1254	3	12	2	33	56	18	6		4			
ME-1255	4	11	3	30	54	18	6	9	4			
ME-1256	4	8	5	25	48	13		5	2	31		
ME-1257	3	8	6	28	34	22		5		24		
ME-1258	2	12	3	33	40	17	4		5			
ME-1259	2	11	3	32	41	12		6	4			
ME-1260	3	8	6	22	33	20		8		15	1	
ME-1261	2	9	1	27	51	13	13	9	4			
ME-1262	2	10	3	25	63	16	10	9				
ME-1263		10	3	42	35	11					1	
ME-1264	3	12	6	30	24	10				20	1	
ME-1265		7	8	19	22	11		5		37		
ME-1266	3	8	6	23	34	14	3	6		20		
ME-1267	3	7	8	20	26	13	3	4		27	2	
ME-1268	3	6	8	18	16	12	3	4		32		
ME-1269	2	6	6	15	21	11	5	6		47	1	
ME-1270	4	7	6	20	22	12	3	9		38	1	
MZ-1272	4	9	4	25	38	21	5	10				
MZ-1274	2	7	3	24	84	11	13	12				
MZ-1276		9	4	26	48	24	17	10	4		2	
MZ-1278	3	7	4	26	37	19	3	6		32		
MZ-1280	3	11	1	37	43	19	4	4				
MZ-1282	3	10	3	24	37	27	8	8		20		
MZ-1284	4	7	4	29	36	17		5		18		
MZ-1286	3	10	2	47	37	18	4	3				
MZ-1288	2	8	5	30	51	25	3	8				
MZ-1289		5	5	25	57	22	5	5		28		
MZ-1292		6	5	24	51	19		4		37		
MZ-1295	2	8	3	31	66	19	4	9				
MZ-1300		6	4	27	64	18	6	5		22		
MZ-1302	3	8	4	35	39	14	3	3		24		
MZ-1304	2	8	4	37	41	14		3		21		
MZ-1306	5	6	3	25	33	13	4	6		18	2	
MZ-1308	5	7	3	31	39	23	2	5				
MZ-1310	5	8	1	35	52	24	8	7				
MZ-1312	7	9	2	24	37	37	21	7				
MZ-1314	7	9		26	37	33	22	6				
MZ-1316	4	6	2	30	34	34	10	5				
MZ-1318	7	6		30	36	41	19	14				
MZ-1320	5	6	2	24	35	30	10	5		22		
MZ-1322	4	6	10	20	40	18	6	4		23		
MZ-1324	5	7	7	32	40	19						
MZ-1326	8	9	3	44	26	26	4					20
MZ-1328	4	9	3	28	55	22	4	5				
MZ-1330	3	6	6	21	33	25	8	6		18		
MZ-1332	3	5	5	26	41	27	4	10		16		
MZ-1334	3	9	4	22	51	42	5	8		17		

Table A-2. X-ray diffraction results, core hole 15/16 (continued).

SAMPLE ID	ANALCIME	QUARTZ	CALCITE	DOLOMITE	NA FELDSPAR	K FELDSPAR	MAGN.SID.	PYRITE	ILLITE	ARAGONITE	DAWSONITE	FLUORITE
	(.........ESTIMATED PERCENT.........)				(.................................PEAK HEIGHT.................................)							
MZ-1336	2	6	7	30	41	22	4					
MZ-1338		11	2	41	49	25						
MZ-1340		6	4	36	60	27	2					
MZ-1342		4	2	34	61	34	3	4				
MZ-1344		6	3	25	110	42	10	4				
MZ-1346	3	3	1	27	87	44	6					
B6-1372	2	4	1	29	66	58	14	6				
RCS-1377		4		27	57	62	12	7				
RCS-1382		5	5	32	44	34	4	2				
RCS-1387	3	6	5	26	39	21	3	10				
RCS-1392	5	7	1	35	49	26	3	6				
RCS-1397		5	3	29	76	19		14				
RCS-1402		5	2	27	100	24	6	12				
RCS-1407		5	8	27	68	21		6				
RCS-1412		5	5	29	69	23	3	9				
RCS-1417		4	2	34	87	34	7	13				
RCS-1422		5	6	27	40	37	7	9				
RCS-1426		6	4	36	24	38	5	7				
RCS-1445	6	10	1	28	25	17	8	10	6			
RCS-1450	7	8	2	34	9	12	7	9	6			
RCS-1455	7	11	1	35	12	13	7	9	8			
RCS-1460	7	9	1	35	10	11	9	3	7			
RCS-1465	7	10	2	29	16	15	6	5	5			
RCS-1468	6	9		23	16	42	17	6	7			
PCS-1518	8	11	2	27	16	22	14	6	7			
PCS-1568	9	10	2	22	15	22	12	5	5			
PCS-1618	10	9	2	25	18	18	5	6	4			
PCS-1668	8	11	1	29	38	36	7	7	3			
PCS-1718	9	10	1	31	18	31	5	7	3			
PCS-1768	9	10	1	31	17	22	9	8	4			
PCS-1818	9	13	2	31	31	30	7	7	3			
PCS-1868	10	12	2	32	19	18	7	4	6			
PCS-1918	7	17	3	21	27	22	9	4	8			
PCS-1968	8	14	2	27	17	17	6	5	11			
PCS-2019	5	13	3	32	14	10		6	9			

Table A-3a. Elemental analysis, core hole 15/16.

SAMPLE ID	AG	AL	AS	AU	B	BA	BR	C(MIN)	C(ORG)	CA	CD	CE	CL	CO	CR
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	OES PPM	NAA PPM	XRF PPM	GRAV PERC	COMB PERC	NAA PERC	IZAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM
APPROX ERR	.5	.10	1.5	.015	.2*R	15	.35	.02		.6	.04	.7	.030	.20	3.0
COS- 860	< 1.4	3.15	39.5	.029	30.	614	.43	5.75	7.21	13.3		37.0	.039	8.24	33.1
COS- 865	< 1.1	4.22	22.3	.019	50.	567	< .68	5.88	4.12	14.7		42.5	<.066	7.87	36.7
COS- 870	1.0	3.56	22.4	<.044	50.	465	< .72	5.70	4.76	12.1		42.9	<.064	7.49	36.7
COS- 875	.7	4.43	15.1	<.038	60.	508	.40	6.14	4.14	14.0		36.9	<.052	7.14	35.0
COS- 880	.8	4.61	33.8	.035	60.	538	< .70	4.81	3.43	9.6		50.9	<.068	9.56	43.0
COS- 885	.6	3.50	47.8	.021	30.	522	< .71	5.67	6.42	13.5		41.3	<.067	8.51	35.7
COS- 890	< 1.2	3.58	33.3	<.036	30.	437	.43	5.28	6.44	13.6		40.8	<.060	8.58	32.8
COS- 895	.8	3.16	25.2	<.038	30.	497	<1.04	5.97	4.47	13.5		40.3	<.076	7.60	35.2
COS- 900	.7	3.58	33.1	<.048	40.	478	.37	5.26	6.14	11.4		39.8	<.060	8.73	40.1
COS- 905	.6	3.75	38.6	.043	80.	512	< .89	5.20	7.58	10.8		40.7	<.072	10.04	37.2
COS- 910	1.7	4.26	30.8	.032	80.	481	< .70	5.36	4.17	11.6		48.5	<.075	9.78	38.7
COS- 915	< 1.1	3.78	39.3	.045	80.	493	< .71	5.36	6.99	12.5		40.1	<.065	8.60	35.0
COS- 920	1.0	4.20	33.8	.034	100.	498	.41	4.91	7.30	10.6		40.3	<.060	9.60	43.7
COS- 925	< 1.7	4.23	50.2	.050	100.	521	< .71	5.08	7.13	11.7		44.6	.044	10.69	39.6
COS- 930	.5	3.27	44.2	.023	80.	536	.43	6.05	6.66	14.8		34.7	.051	8.87	33.2
COS- 935	.5	3.66	51.5	.018	100.	497	< .95	5.32	8.41	12.4		36.9	.106	9.91	35.4
COS- 940	.9	2.91	55.5	.025	70.	490	< .73	6.30	7.11	15.6		32.4	.035	7.74	28.0
COS- 945	.4	2.14	45.6	.018	40.	515	< .77	7.13	6.83	17.3		24.5	<.056	6.51	21.7
COS- 950	1.0	2.39	49.7	<.038	40.	522	< .93	5.56	8.80	16.9		26.4	<.077	7.20	20.8
COS- 955	.5	2.97	34.5	<.031	50.	505	.40	5.82	7.72	13.5		27.5	.074	7.75	25.2
COS- 960	.9	3.73	32.0	.019	80.	469	< .77	5.21	6.98	11.2		37.8	<.066	9.52	35.2
COS- 965	1.4	2.94	42.5	<.038	80.	467	< .75	5.92	7.86	12.3		30.3	<.089	8.29	28.2
COS- 970	.6	3.49	50.2	.025	80.	530	< .78	4.93	10.91	12.4		38.0	<.066	9.68	25.8
COS- 975	.7	3.47	37.0	.021	80.	445	< .83	4.57	11.83	12.2		36.0	<.056	10.29	26.9
COS- 980	1.0	4.45	27.2	.027	100.	472	< .67	4.55	7.86	8.9		42.0	<.072	10.47	38.0
COS- 985	1.5	3.65	25.9	<.040	80.	522	< .68	5.36	6.98	11.5		38.5	<.075	8.75	32.6
COS- 990	< 1.4	4.17	30.1	<.042	100.	540	< .72	5.05	7.93	10.8		40.2	<.066	9.56	30.8
COS- 995	.9	4.13	29.2	<.035	120.	444	< .68	4.83	5.93	9.7		40.0	.043	9.06	39.0
COS-1000	.8	4.02	32.1	<.039	60.	402	< .76	5.48	5.86	10.5		37.1	<.067	8.25	37.5
COS-1005	.7	3.96	23.8	<.041	120.	502	< .80	4.79	4.47	9.3		44.5	<.062	9.39	42.7
COS-1010	1.3	3.23	46.7	<.044	120.	468	< .95	4.75	10.58	9.6		38.9	<.046	9.46	30.5
COS-1015	< 1.6	4.21	31.2	<.039	120.	474	< .97	4.62	5.15	8.4		48.7	.055	10.24	45.5
COS-1020	.8	2.96	43.2	<.041	90.	517	.42	5.54	8.04	12.1		36.8	<.046	7.62	28.5
COS-1025	< 1.2	3.51	31.7	<.040	80.	453	< .75	5.80	4.68	10.6		42.1	.039	8.04	36.0
COS-1030	.6	3.58	63.0	.437	100.	509	< .71	4.99	9.81	9.1		37.1	<.108	8.97	31.1
COS-1035	< 1.4	4.94	66.9	.018	150.	497	.54	4.20	6.21	7.8		51.6	<.137	10.95	34.0
COS-1040	1.2	3.34	43.1	<.046	80.	605	< .99	5.17	11.68	13.3		40.5	<.086	8.66	30.7
COS-1045	.6	4.01	40.9	<.038	70.	535	.55	5.88	4.49	11.0		42.1	<.091	8.38	33.0
COS-1050	< 1.4	3.42	44.7	<.046	60.	572	<1.02	5.61	6.87	12.7		38.3	<.086	8.49	30.0
COS-1055	.7	3.61	33.0	<.041	60.	523	< .83	5.25	6.40	10.1		44.3	.055	8.71	30.8
COS-1060	.6	3.58	50.2	.026	70.	531	< .90	4.70	11.27	11.6		38.8	<.068	9.42	35.1
COS-1065	.7	3.84	27.5	.268	120.	520	< .86	5.70	5.79	11.7		42.6	<.060	8.52	32.0
COS-1070	< 1.0	3.89	38.7	.031	100.	446	< .80	4.85	8.27	9.2		43.5	.035	8.71	25.2
COS-1075	.7	3.89	47.0	.014	100.	555	< .90	5.00	7.47	10.1		43.4	.078	8.07	31.1
COS-1080	< 1.5	4.26	32.4	.012	250.	528	< .67	4.75	5.72	7.4		50.6	<.066	8.26	35.4
COS-1085	.7	3.76	38.7	.016	60.	572	< .93	5.11	7.80	10.7		43.1	<.062	6.93	26.7
COS-1090	.9	3.59	36.7	<.033	50.	558	< .97	5.80	5.78	12.7		39.5	<.060	6.66	30.2
COS-1095	< 1.0	2.46	25.1	<.034	50.	528	< .68	6.63	6.42	14.3		27.9	<.050	5.68	22.1

Table A-3a. Elemental analysis, core hole 15/16 (continued).

SAMPLE ID	AG	AL	AS	AU	B	BA	BR	C(MIN)	C(ORG)	CA	CD	CE	CL	CO	CR
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	OES PPM	NAA PPM	XRF PPM	GRAV PERC	COMB PERC	NAA PERC	IZAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM
APPROX ERR	.5	.10	1.5	.015	.2*R	15	.35	.02		.6	.04	.7	.030	.20	3.0
COS-1100	< 1.3	3.11	29.0	.014	50.	525	< .69	6.35	5.27	14.0		33.3	.034	6.18	26.3
COS-1105	.7	2.81	39.7	<.028	50.	524	.60	6.37	6.67	13.4		31.5	<.066	6.31	27.8
CCS-1110	.5	3.39	43.7	<.026	50.	495	.43	5.74	6.96	12.7		37.2	<.077	7.22	29.4
COS-1115	1.1	3.19	42.2	<.039	50.	528	< .92	6.02	7.74	14.1		35.7	<.056	7.67	31.7
COS-1120	1.1	3.C5	41.4	.020	60.	466	.70	6.11	7.04	13.0		34.9	<.074	7.17	25.0
CCS-1125	< 1.2	2.91	42.2	.026	50.	529	<1.00	6.31	7.83	15.4		34.0	.028	7.01	29.8
COS-1130	.7	2.29	28.4	<.019	50.	476	< .89	6.96	5.33	13.5		28.2	.043	5.21	23.7
COS-1135	1.2	3.79	29.8	<.036	50.	531	< .95	4.94	6.23	11.1		42.3	<.C74	6.26	24.9
COS-1140	1.0	2.64	40.6	.015	50.	508	< .72	6.83	6.47	16.6		28.6	.068	6.34	29.7
COS-1145	< 1.3	2.47	50.6	.228	70.	523	< .75	6.44	9.21	15.6		29.0	.039	7.32	25.8
CCS-1150	1.0	3.31	52.3	.024	70.	493	< .98	5.76	9.73	14.3		35.0	.062	8.76	30.5
CCS-1155	1.4	3.43	40.8	<.032	70.	535	.54	6.46	5.14	13.5		37.2	<.066	7.33	29.7
CCS-1160	< 1.2	2.71	38.5	.020	60.	509	.74	6.60	7.07	14.6		30.9	<.080	6.72	29.9
CCS-1165	.5	3.74	42.4	<.037	70.	446	< .71	6.18	4.36	11.5		38.8	<.063	7.53	35.8
COS-1170	< 1.0	2.99	41.3	.021	70.	464	< .71	6.43	8.80	13.5		32.5	.C34	7.95	31.6
CCS-1175	< 1.0	3.92	65.8	.016	70.	488	< .93	5.49	7.88	11.4		41.2	<.064	9.65	34.6
COS-1180	.6	3.07	71.5	<.035	70.	512	.47	5.89	9.65	14.1		35.4	<.064	9.00	27.4
COS-1185	< 1.3	2.84	52.2	<.038	70.	511	< .79	6.51	7.77	14.4		34.6	.088	7.34	29.2
COS-1190	< 1.3	3.04	55.3	<.032	80.	454	.39	5.36	12.68	13.2		34.1	.041	9.38	32.4
CCS-1196	< 1.0	3.49	39.7	.019	80.	463	.46	5.68	8.85	12.1		39.6	<.052	9.54	33.9
COS-12C5	1.5	4.51	31.1	.012	150.	528	.76	5.27	3.72	8.7		47.9	<.050	9.14	44.0
COS-1208	.9	5.86	34.3	.026	150.	411	.97	3.44	4.06	5.6		56.7	.042	11.56	46.0
MZ-1210	.6	4.42	35.1	<.037	150.	602	.46	5.02	7.37	8.4		45.7	<.083	7.93	41.4
MZ-1212	< 1.2	3.39	16.0	<.029	80.	509	< .65	5.49	8.35	9.1		36.3	<.056	6.87	30.4
MZ-1214	.5	3.33	34.8	.019	80.	534	< .87	4.73	14.43	9.6		35.4	.055	10.10	31.3
MZ-1216	.7	3.53	25.5	.023	50.	519	< .90	5.54	9.14	10.5		45.5	<.064	9.43	34.7
MZ-1218	< 1.0	3.58	21.0	.016	50.	743	< .66	5.51	8.10	8.7		41.7	<.092	7.40	33.4
MZ-1220	1.2	4.13	78.4	.019	50.	534	.38	3.44	14.68	6.2		50.4	.068	13.79	32.7
MZ-1222	< 1.4	3.02	49.1	<.052	50.	549	.48	5.28	12.20	13.6		36.8	<.074	10.C0	29.0
MZ-1224	.9	3.23	63.5	<.036	5C.	429	< .67	3.67	20.59	9.3		36.5	.053	10.22	29.5
MZ-1226	.7	2.96	41.2	.027	50.	534	< .69	4.78	14.18	13.2		35.9	.065	6.51	30.9
MZ-1228	< 1.3	3.71	39.0	.015	80.	586	< .81	5.07	11.01	11.8		43.3	<.062	8.15	35.3
MZ-1230	.8	3.81	42.1	.024	80.	558	< .75	5.43	7.87	11.3		43.5	<.060	8.43	40.8
MZ-1232	.9	3.22	37.1	.017	80.	555	< .83	5.95	9.66	12.9		37.5	<.060	7.07	33.3
MZ-1234	< 1.6	4.41	40.1	.025	80.	459	< .68	4.49	5.78	8.7		52.7	<.058	7.65	41.3
MZ-1236	1.1	5.14	37.6	.018	80.	493	< .95	4.09	5.20	6.5		55.6	.032	9.49	42.4
MZ-1238	.8	4.64	62.8	.019	80.	485	< .92	5.05	4.74	8.8		52.5	<.072	10.04	45.6
MZ-1240	< 1.0	3.37	51.2	.019	80.	468	< .83	5.05	15.67	9.2		38.0	<.058	10.73	28.2
MZ-1242	1.2	3.50	64.1	.017	80.	538	< .88	5.25	11.18	10.6		41.0	<.058	9.06	34.3
MZ-1244	.5	2.77	38.2	<.026	70.	439	< .65	5.24	14.34	10.7		32.0	<.C54	7.14	29.0
ME-1245	.5	3.68	131.8	.027	8C.	423	< .77	3.89	19.88	8.6		41.1	.059	12.51	4C.2
ME-1246	.7	3.C0	114.9	.019	50.	421	< .77	5.07	16.66	12.3		39.5	<.1C0	11.2C	33.2
ME-1247	< .7	1.97	68.4	.016	50.	353	< .72	5.57	16.55	15.6		23.1	.046	7.72	23.C
ME-1248	.6	3.61	54.4	<.050	120.	360	.50	3.06	20.24	6.8		38.6	<.058	12.30	38.0
ME-1249	.8	3.11	30.2	<.048	120.	242	< .61	2.51	30.66	4.8		31.3	<.C68	13.80	32.5
ME-1250	< 1.3	2.68	27.5	<.055	80.	250	< .57	1.90	34.50	6.2		28.0	.033	11.21	33.5
ME-1251	.8	2.95	27.5	<.052	100.	273	< .58	2.06	30.36	5.9		28.0	<.101	10.60	32.3
ME-1252	< 1.3	3.31	62.5	<.052	120.	276	< .62	1.90	29.52	6.1		35.3	<.066	13.43	32.8

Table A-3a. Elemental analysis, core hole 15/16 (continued).

SAMPLE ID	AG	AL	AS	AU	B	BA	BR	C(MIN)	C(ORG)	CA	CD	CE	CL	CO	CR
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	DES PPM	NAA PPM	XRF PPM	GRAV PERC	COMB PERC	NAA PERC	IZAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM
APPROX ERR	.5	.10	1.5	.015	.2*R	15	.35	.02		.6	.04	.7	.030	.20	3.0
ME-1253	< 1.2	3.19	131.1	<.048	100.	362	< .74	3.04	24.47	9.9		35.5	<.060	10.75	33.3
ME-1254	.7	2.90	34.2	<.034	120.	315	< .64	4.05	20.45	9.2		31.1	.063	8.52	32.1
ME-1255	< 1.4	3.C9	81.7	.024	120.	434	<1.04	4.46	17.98	10.1		37.6	<.054	9.99	30.0
ME-1256	< 1.0	2.95	74.1	.021	100.	526	< .75	5.33	13.50	14.2		34.1	<.074	8.92	23.5
ME-1257	< 1.3	2.62	59.3	<.041	80.	496	< .96	5.57	14.70	13.7		30.5	.062	8.19	27.3
ME-1258	.7	2.87	70.1	<.045	100.	350	.87	4.18	19.05	10.0		32.4	<.059	9.84	28.9
ME-1259	.5	2.53	74.3	<.038	100.	379	< .85	5.15	16.75	11.8		27.2	.047	7.59	31.4
ME-1260	< 1.4	2.68	98.8	.025	100.	496	.83	4.86	15.63	13.7		32.9	.061	9.88	23.7
ME-1261	.6	3.28	85.1	.025	100.	388	1.35	3.43	22.09	7.5		35.2	<.079	11.94	35.4
ME-1262	< 1.4	2.76	133.6	.036	150.	402	.68	3.54	21.28	9.2		32.0	<.086	10.51	32.3
ME-1263	< 1.0	2.27	45.1	<.037	60.	420	.85	7.04	12.84	14.0		24.1	.036	4.66	23.9
ME-1264	< .8	2.03	67.7	<.042	60.	441	<1.11	6.29	10.47	15.6		21.4	<.057	4.81	27.8
MB-1265	.5	2.01	67.0	<.032	60.	575	1.17	6.96	10.94	18.8		23.4	.044	5.72	23.8
ME-1266	< 1.2	2.7C	71.9	<.051	60.	501	.41	5.83	12.64	15.8		30.5	.043	6.79	26.2
ME-1267	.6	2.21	68.3	<.038	50.	541	.82	6.62	10.60	18.8		25.6	.086	5.61	21.8
ME-1268	< .7	1.84	62.4	<.042	50.	559	<1.16	6.84	11.97	20.4		21.5	.058	5.28	22.2
ME-1269	< 1.0	1.82	63.9	<.041	50.	625	< .79	6.73	12.95	21.4		20.9	<.050	6.16	17.9
ME-1270	.6	2.37	54.1	<.038	60.	544	< .76	6.84	19.38	17.9		24.0	<.050	5.95	22.2
MZ-1272	< 1.4	2.82	80.4	.030	100.	387	.57	4.97	20.09	10.0		31.8	<.083	1C.99	29.9
MZ-1274	.8	3.39	90.4	<.055	80.	421	< .97	3.94	19.10	9.8		37.7	<.068	10.46	31.5
MZ-1276	< 1.6	4.29	17.3	<.055	80.	455	.52	4.85	12.17	9.4		45.5	<.068	11.85	34.8
MZ-1278	< .9	2.40	43.2	.103	60.	547	.53	6.34	11.51	15.9		28.1	.038	6.94	25.0
MZ-1280	< 1.2	2.93	26.5	.020	80.	411	.43	6.54	10.56	9.8		31.2	.059	7.40	28.9
MZ-1282	.5	3.26	48.6	<.045	70.	476	.36	4.07	16.36	10.0		35.1	<.099	10.75	29.4
MZ-1284	.6	3.41	34.5	.021	50.	530	.81	5.94	7.93	13.3		39.8	<.091	8.50	35.4
MZ-1286	.7	2.73	25.3	.025	60.	417	< .71	5.93	11.09	12.1		30.4	<.077	7.37	28.3
MZ-1288	1.2	2.8C	45.0	<.057	60.	405	< .73	3.97	19.29	10.9		30.8	.032	9.96	27.0
MZ-1289	< 1.4	2.54	36.1	<.047	30.	470	.50	5.38	15.62	14.3		27.1	<.052	7.03	23.5
MZ-1292	< 1.0	2.36	44.0	<.038	40.	548	.55	5.56	15.86	15.5		26.6	.070	6.94	27.2
MZ-1295	1.1	2.87	44.7	.051	40.	450	.54	4.68	18.71	10.8		30.7	<.062	8.39	26.0
MZ-1300	.5	2.51	31.6	<.040	30.	573	< .71	4.45	14.41	15.3		28.2	<.092	6.74	23.4
MZ-13C2	< 1.4	2.36	24.3	.017	40.	518	< .74	7.19	7.61	16.2		26.9	<.070	5.29	24.4
MZ-1304	< .8	2.10	24.6	.023	30.	555	<1.00	7.08	9.99	15.8		23.9	.041	4.97	21.5
MZ-13C6	.6	3.68	44.3	<.052	40.	611	.43	5.64	8.68	13.4		42.9	<.088	10.13	37.0
MZ-13C8	.7	3.42	20.8	.026	30.	534	.59	6.58	5.93	14.0		36.4	.051	7.01	29.2
MZ-1310	1.0	3.73	21.5	<.044	50.	477	< .88	5.42	8.41	9.5		40.6	<.066	8.69	39.1
MZ-1312	1.4	5.05	30.3	<.058	40.	572	< .91	4.34	7.43	7.7		50.4	.032	9.97	38.6
MZ-1314	1.0	5.34	24.6	.034	40.	556	< .74	4.43	5.15	7.5		55.5	.054	11.40	47.0
MZ-1316	1.1	3.93	47.9	.030	40.	593	< .79	5.14	10.41	10.3		44.1	.045	10.79	40.2
MZ-1318	1.3	5.56	76.3	.152	40.	566	.75	4.23	5.98	6.8		60.1	<.078	14.27	48.8
MZ-1320	< 1.0	3.49	72.4	<.053	40.	519	< .72	4.90	15.04	9.9		38.5	.061	11.45	27.8
MZ-1322	.5	2.61	51.6	.035	30.	688	<1.04	6.07	11.49	17.5		32.0	<.064	6.49	21.5
MZ-1324	< 1.0	3.53	27.8	<.039	30.	588	.47	6.35	6.14	13.1		37.9	<.068	6.22	30.8
MZ-1326	< 1.3	3.37	14.5	<.035	50.	500	< .80	6.48	4.37	13.6		37.0	.030	4.97	34.1
MZ-1328	< 1.0	3.73	33.3	<.047	30.	475	.46	5.25	9.18	10.1		39.2	.034	6.25	26.7
MZ-1330	.9	3.03	41.5	.022	40.	608	< .71	5.00	16.70	12.6		36.4	.056	8.49	27.0
MZ-1332	< 1.3	3.35	23.6	.019	50.	586	< .86	5.33	13.78	11.6		39.6	<.052	8.38	37.4
MZ-1334	< 1.4	4.84	23.5	<.038	100.	528	< .96	4.22	7.32	9.7		56.0	.031	10.23	35.2

Table A-3a. Elemental analysis, core hole 15/16 (continued).

SAMPLE ID	AG	AL	AS	AU	B	BA	BR	C(MIN)	C(ORG)	CA	CD	CE	CL	CO	CR
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	DES PPM	NAA PPM	XRF PPM	GRAV PERC	COMB PERC	NAA PERC	IZAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM
APPRCX ERR	.5	.10	1.5	.015	.2*R	15	.35	.02		.6	.04	.7	.030	.20	3.0
MZ-1336	.9	3.06	30.5	.019	30.	724	.53	6.75	6.84	14.9		35.7	<.074	6.18	35.8
MZ-1338	< 1.1	3.32	17.4	<.041	30.	489	< .71	6.46	4.66	12.0		34.9	.062	5.82	34.2
MZ-1340	.6	3.55	31.8	.018	30.	471	< .77	6.62	4.94	14.2		39.6	<.084	6.35	35.0
MZ-1342	.9	4.13	28.4	.022	40.	476	.60	5.95	5.15	11.3		46.1	.062	7.62	41.4
MZ-1344	1.5	5.40	36.0	<.040	40.	449	< .88	3.91	5.71	9.6		51.8	<.092	9.58	53.2
MZ-1346	< 1.4	5.78	20.2	<.050	40.	537	< .85	3.87	5.89	8.3		62.8	<.109	10.67	59.4
BG-1372	< 2.0	6.11	21.8	<.049	100.	449	.43	4.01	1.91	7.9		68.3	<.080	10.47	62.5
ROS-1377	1.4	6.85	11.2	.043	120.	449	< .67	3.36	2.19	5.7		45.3	<.090	11.86	56.2
ROS-1382	< 1.0	3.54	16.9	<.040	50.	1232	<1.03	6.45	5.31	13.8		40.4	<.076	7.22	37.2
ROS-1387	< 1.2	2.93	15.9	<.034	50.	640	< .67	5.63	14.22	12.7		34.2	<.068	8.01	28.6
ROS-1392	< 1.3	4.37	14.5	<.042	70.	549	< .91	5.37	5.23	9.8		47.6	<.140	8.68	47.2
ROS-1397	.5	3.34	5.2	<.044	30.	623	.51	6.27	7.99	12.1		37.1	<.125	8.04	38.5
ROS-1402	< 1.1	4.17	10.5	<.049	40.	627	< .80	4.88	10.68	10.6		48.2	<.117	10.10	40.7
ROS-1407	< 1.2	3.33	6.9	<.039	25.	657	< .68	6.77	7.12	15.5		34.2	.059	6.74	34.6
ROS-1412	< 1.3	3.32	9.7	<.039	25.	570	< .75	5.47	10.05	11.4		37.8	<.076	9.53	36.6
ROS-1417	< 1.5	2.59	8.1	<.041	40.	545	< .84	5.54	9.81	7.2		41.7	<.078	10.89	36.2
ROS-1422	< 1.4	3.49	9.8	<.041	80.	756	< .76	5.49	7.96	12.9		40.7	<.068	8.95	28.6
ROS-1426	.5	3.56	8.1	.040	80.	747	.78	6.26	5.27	12.5		43.0	<.084	8.21	40.7
ROS-1445	< 1.3	3.83	21.7	.026	200.	458	< .93	4.47	12.94	8.8		42.2	.033	11.37	41.2
ROS-1450	.7	3.64	17.4	<.036	200.	525	<1.00	5.62	8.96	10.6		36.9	<.057	8.52	36.6
ROS-1455	< 1.2	4.20	13.6	<.029	200.	433	1.14	5.04	6.25	9.0		46.7	<.096	8.71	43.6
ROS-1460	< 1.5	4.09	15.4	<.039	200.	437	.84	5.08	8.95	8.6		41.7	.033	9.12	37.2
ROS-1465	1.2	4.52	18.6	<.028	150.	462	.73	4.64	8.12	8.7		43.2	.035	9.12	45.4
ROS-1468	1.1	6.72	27.7	.020	150.	451	1.01	3.46	4.14	5.1		69.2	.122	12.48	60.4
POS-1518	< 1.0	5.52	19.9	<.030	150.	542	.90	4.33	4.66	7.5		54.5	.072	9.63	47.4
POS-1568	1.5	6.12	17.7	<.033	150.	513	1.20	3.79	2.88	7.3		64.6	.080	10.56	2
POS-1618	1.7	5.11	21.3	.018	100.	483	.41	4.40	5.22	9.0		53.8	<.083	9.84	[illegible]
POS-1668	1.1	5.77	5.8	<.034	100.	490	< .64	4.03	1.72	7.3		59.8	<.080	9.20	56.8
POS-1718	< 1.2	5.50	6.8	<.040	100.	585	.35	4.46	1.70	8.9		55.0	<.068	8.95	53.5
POS-1768	1.2	5.44	13.5	<.044	70.	490	< .89	4.60	3.95	8.4		50.8	<.070	9.10	54.6
POS-1818	1.0	4.93	20.9	<.036	40.	513	< .74	4.44	4.86	9.3		50.8	<.111	8.66	49.4
POS-1868	1.4	4.65	16.9	.016	50.	463	.45	4.55	4.89	8.2		48.7	.046	8.08	49.1
POS-1918	< 1.3	5.68	10.9	<.038	70.	513	< .92	3.57	2.01	7.0		56.6	<.090	8.17	67.2
POS-1968	1.1	5.26	16.8	<.041	70.	471	.44	4.10	3.58	6.7		52.7	.046	8.67	64.7
POS-2019	< 1.5	3.80	11.9	.043	60.	473	.83	5.42	3.38	11.4		43.9	.052	6.60	45.5

Table A-3b. Elemental analysis, core hole 15/16.

SAMPLE ID	CS	CU	DY	EU	F	FE	GA	GE	H	HG	HF	IN	IR	K	LA
ANAL.METH.	NAA PPM	XRF PPM	NAA PPM	NAA PPM	SP PERC	NAA PERC	XRF PPM	XRF PPM	COMB PERC	IZAA PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM
APPROX ERR	.15	1.5	.08	.010	.03*R	.03	.7	.60	.02	.1*R	.05	.10	.004	.20	.5
COS- 860	7.58	28.9	2.09	.585	.151	1.89	8.3	<1.76	.98	.091	1.72	.07	<.007	1.50	18.3
COS- 865	5.68	25.6	2.66	.677	.163	2.15	9.5	<1.34	.70	.058	1.58	.14	.006	1.45	19.7
COS- 870	5.79	26.5	2.70	.673	.111	2.12	9.3	<1.57	.75	.054	1.53	.11	<.006	1.33	19.8
COS- 875	2.58	25.2	2.22	.551	.068	1.91	8.9	1.02	.66	.043	1.40	< .14	<.008	2.43	17.6
COS- 880	6.50	29.1	2.98	.742	.081	2.64	11.7	1.05	.60	.074	1.96	< .14	<.006	2.56	23.7
COS- 885	6.87	30.5	2.41	.621	.043	1.97	9.2	1.35	.84	.085	1.76	< .13	<.006	1.79	20.2
COS- 890	4.84	23.1	2.40	.621	.206	1.81	9.5	.98	.91	.066	1.54	.18	<.006	1.52	19.2
COS- 895	5.57	30.2	2.06	.569	.068	1.89	8.7	1.27	.58	.061	1.65	< .21	<.006	1.29	18.8
COS- 900	5.35	28.7	2.10	.556	.108	1.95	9.4	.94	.88	.069	1.75	< .17	<.006	1.23	19.1
COS- 905	5.40	31.2	2.26	.616	.198	2.14	9.8	.74	1.00	.075	1.71	.04	<.006	2.05	19.7
COS- 910	5.92	35.5	2.88	.749	.150	2.49	10.6	.97	.65	.078	1.76	.09	<.006	1.94	23.1
COS- 915	4.88	30.5	2.27	.604	.153	2.06	9.3	1.26	1.01	.088	1.78	.04	.007	1.72	18.5
COS- 920	5.91	34.7	2.19	.639	.164	2.37	9.2	.82	.96	.080	1.85	< .24	.003	2.18	20.2
COS- 925	5.34	39.0	2.43	.677	.147	2.54	10.6	<1.64	1.03	.111	1.70	.18	<.008	2.63	21.8
COS- 930	5.36	34.1	1.31	.544	.143	2.01	7.2	1.02	.97	.101	1.55	< .18	<.008	1.59	16.8
COS- 935	4.89	38.7		.577	.062	2.24	7.6	.82	1.17	.114	1.56	< .27	<.006	2.04	19.5
COS- 940	5.09	32.3		.503	.057	1.73	6.9	.94	1.02	.101	1.30	.25	<.005	1.27	17.1
COS- 945	3.36	19.9		.383	.132	1.32	5.2	<1.49	1.00	.075	1.27	< .30	<.006	.72	12.2
COS- 950	3.91	23.7		.403	.057	1.35	5.5	<1.84	1.04	.070	1.31	< .26	<.005	.89	13.2
COS- 955	4.53	24.8	1.51	.404	.015	1.76	7.9	<1.56	1.03	.056	1.43	< .12	<.005	1.40	14.6
COS- 960	4.23	27.0	1.91	.519	.018	2.21	9.4	.91	1.04	.063	1.92	.14	<.006	2.10	19.5
COS- 965	5.42	22.6	1.62	.435	.024	1.71	6.0	1.24	1.11	.081	1.52	.06	<.005	.94	15.1
COS- 970	4.81	28.0	2.03	.528	.019	1.91	7.6	<1.18	1.51	.065	1.84	< .19	<.006	1.32	19.7
COS- 975	5.49	33.2	1.90	.534	.110	2.12	7.3	1.26	1.65	.061	1.76	.08	<.008	1.19	19.0
COS- 980	3.61	34.4	2.14	.583	.124	2.54	10.8	.81	1.22	.061	1.81	< .17	<.006	2.32	22.4
COS- 985	6.10	28.2	2.00	.538	.129	2.05	8.0	1.37	.97	.060	1.89	< .16	<.006	1.54	15.7
COS- 990	5.21	30.6	2.13	.590	.127	2.17	8.6	1.23	1.14	.061	1.79	.11	<.006	1.88	21.1
COS- 995	5.00	31.4	2.22	.574	.112	2.42	9.8	1.69	.96	.036	1.77	< .16	<.006	2.22	20.1
COS-1000	4.86	22.5	1.88	.522	.043	2.04	9.6	1.92	.92	.073	1.66	.11	<.006	1.18	18.1
COS-1005	6.34	30.2	2.38	.645	.175	2.51	11.2	<1.16	.81	.038	2.00	< .35	<.007	2.18	22.2
COS-1010	3.80	32.3	1.97	.551	.219	2.11	8.4	1.81	1.51	.120	1.53	.18	<.007	2.34	18.7
COS-1015	6.75	34.0	2.57	.708	.100	2.81	13.0	.92	.90	.075	1.88	< .31	<.008	2.11	24.6
COS-1020	4.56	23.0	2.25	.560	.176	1.78	9.0	1.45	1.14	.098	1.48	< .28	<.006	1.39	17.5
COS-1025	5.42	32.3	2.35	.635	.134	2.18	9.5	.95	.82	.049	1.63	< .48	.004	1.56	20.7
COS-1030	3.70	28.1	2.05	.567	.155	1.92	8.8	1.23	1.37	.116	1.63	.22	<.006	1.96	18.5
COS-1035	6.93	37.9	2.29	.735	.143	2.73	12.5	1.13	1.00	.111	2.17	.28	<.007	2.67	25.2
COS-1040	5.37	34.5	2.45	.612	.229	1.85	8.5	.83	1.65	.096	1.74	< .32	<.006	1.77	19.4
COS-1045	4.15	33.5	2.46	.639	.062	2.10	9.4	1.38	.71	.074	1.80	< .38	<.006	2.08	21.0
COS-1050	6.00	26.5	2.01	.582	.135	1.75	8.6	<1.70	1.00	.071	1.99	.27	<.006	1.12	18.9
COS-1055	4.82	35.8	2.40	.640	.133	2.03	10.1	.68	.89	.066	1.89	.12	<.007	1.60	22.7
COS-1060	5.21	37.5	2.05	.575	.137	2.04	9.1	1.49	1.52	.107	1.77	< .10	<.006	2.12	20.4
COS-1065	.94	29.8	2.28	.620	.097	2.19	10.1	1.71	.90	.059	1.46	< .10	<.007	2.89	21.4
COS-1070	2.83	29.4	2.24	.581	.111	2.10	9.5	.69	1.23	.093	1.89	< .14	<.007	2.49	21.3
COS-1075	4.81	26.4	2.51	.641	.091	1.92	10.2	1.15	1.20	.100	2.14	< .12	.005	1.88	22.0
COS-1080	3.61	31.2	2.64	.729	.128	2.29	10.3	1.03	1.02	.088	1.77	.07	<.009	3.64	26.0
COS-1085	5.48	24.8	2.15	.565	.128	1.76	9.8	.68	1.25	.085	2.45	.07	<.007	2.04	22.2
COS-1090	5.25	22.3	1.90	.561	.091	1.79	9.1	1.49	.96	.048	1.74	< .17	<.006	1.32	19.0
COS-1095	2.87	16.2	1.54	.398	.087	1.32	7.1	<1.19	1.03	.039	1.35	.14	<.005	1.46	14.0

Table A-3b. Elemental analysis, core hole 15/16 (continued).

SAMPLE ID	CS	CU	DY	EU	F	FE	GA	GE	H	HG	HF	IN	IR	K	LA
ANAL.METH.	NAA PPM	XRF PPM	NAA PPM	NAA PPM	SP PERC	NAA PERC	XRF PPM	XRF PPM	COMB PERC	IZAA PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM
APPRCX ERR	.15	1.5	.08	.010	.03*R	.03	.7	.60	.02	.1*R	.05	.10	.004	.20	.5
COS-1100	5.34	20.2	1.88	.490	.102	1.56	7.6	.83	.86	.039	1.54	.20	<.005	.99	17.0
COS-1105	4.26	20.6	1.71	.448	.179	1.55	8.6	.75	.84	.039	1.46	< .14	<.005	1.52	15.0
COS-1110	4.79	24.6	2.02	.551	.207	1.65	8.8	.70	1.00	.048	1.54	.10	<.008	1.36	19.1
COS-1115	4.67	24.6	2.00	.549	.156	1.68	7.6	<1.28	1.11	.050	1.35	.05	<.006	1.78	17.1
COS-1120	2.40	25.6	2.02	.542	.205	1.67	7.2	1.30	.98	.045	1.33	.17	<.006	2.14	17.1
COS-1125	4.76	27.5	1.85	.501	.166	1.58	6.3	<1.35	1.03	.049	1.35	.11	<.006	1.40	16.4
COS-1130	2.06	12.5	1.44	.405	.201	1.23	6.4	<1.56	.75	.033	1.02	.09	<.005	1.33	13.6
COS-1135	5.51	22.7	2.00	.547	.275	1.55	9.2	.83	.98	.034	1.65	.09	<.005	1.15	21.9
COS-1140	3.97	17.9	1.66	.456	.143	1.43	6.8	.89	.90	.047	1.33	.09	.003	1.47	14.2
COS-1145	4.46	25.8	1.70	.451	.121	1.42	4.6	<1.66	1.27	.060	1.18	< .16	<.007	1.14	14.7
COS-1150	3.29	29.1	2.09	.571	.146	1.74	8.3	.65	1.30	.078	1.38	< .15	.003	1.72	16.3
COS-1155	5.67	28.0	2.19	.613	.047	2.00	8.9	1.56	.80	.054	1.39	< .16	<.006	1.46	18.6
COS-1160	4.84	21.4	1.82	.480	.092	1.52	6.8	1.45	.95	.047	1.35	< .13	<.006	1.01	15.4
COS-1165	5.70	26.4	2.14	.596	.119	2.10	10.5	.81	.85	.054	1.48	< .15	<.006	1.42	19.0
COS-1170	5.14	27.0	1.83	.495	.132	1.61	6.3	.89	1.24	.057	1.35	< .15	<.005	1.06	15.7
COS-1175	6.36	39.1	2.25	.652	.119	2.18	8.8	.79	1.16	.094	1.58	< .22	<.006	1.64	20.3
COS-1180	4.56	36.1	2.05	.544	.134	1.82	7.8	<1.62	1.30	.082	1.44	< .10	<.008	1.84	17.0
COS-1185	4.94	23.3	1.81	.518	.176	1.53	7.5	.77	1.15	.068	1.50	.07	<.005	.56	17.0
COS-1190	4.63	30.6	1.78	.517	.206	1.73	6.9	.57	1.80	.105	1.43	< .13	<.006	1.17	16.8
COS-1156	3.52	34.7	2.08	.609	.174	2.02	8.4	.75	1.35	.076	1.34	.10	<.007	1.97	19.8
COS-1205	1.92	28.3	2.67	.723	.080	2.42	11.3	<1.40	.76	.055	1.55	< .16	<.009	4.10	24.0
COS-1203	.75	27.4	2.94	.815	.064	3.11	14.3	1.25	.69	.058	1.95	.08	<.007	5.17	28.9
MZ-1210	.89	27.9	2.64	.687	.084	2.32	11.0	<1.48	1.11	.048	1.47	< .13	<.009	3.72	23.0
MZ-1212	13.87	27.4	1.89	.533	.272	1.80	8.0	<1.65	1.16	.014	1.97	< .11	<.006	1.36	17.8
MZ-1214	6.08	35.2	1.85	.527	.275	1.82	7.8	1.41	1.90	.046	1.86	.09	<.006	1.50	17.5
MZ-1216	5.20	33.9	2.38	.661	.203	2.07	8.0	<1.64	1.28	.055	1.84	< .16	.004	1.81	22.3
MZ-1218	5.74	21.1	1.77	.628	.173	1.70	7.6	.74	1.20	.031	1.93	.09	<.007	.91	21.8
MZ-1220	4.60	47.9	1.98	.711	.169	2.48	10.2	.65	1.85	.140	1.83	.13	<.006	1.69	26.7
MZ-1222	4.18	31.8	2.03	.560	.210	1.98	7.1	.81	1.67	.091	1.68	< .14	<.006	1.40	18.6
MZ-1224	4.34	39.9	2.03	.560	.196	2.00	6.8	<1.59	2.91	.162	1.59	.17	<.007	1.17	18.3
MZ-1226	4.07	24.2	2.04	.555	.281	1.60	7.8	<1.17	1.92	.092	1.60	.07	<.005	1.26	16.8
MZ-1228	4.93	34.3	2.56	.654	.148	2.10	8.5	<1.62	1.62	.070	1.63	.06	<.009	1.98	20.2
MZ-1230	6.78	32.2	2.66	.665	.115	2.23	10.1	.73	1.22	.078	1.77	.12	.004	1.33	20.9
MZ-1232	5.28	28.0	2.17	.555	.077	1.80	9.6	.66	1.44	.028	1.85	< .14	<.006	1.39	17.9
MZ-1234	4.07	31.1	3.94	.756	.213	2.22	12.1	2.22	.99	.059	1.79	.07	<.007	2.55	25.6
MZ-1236	2.50	33.3	3.80	.816	.154	2.66	13.1	1.54	.91	.059	1.81	.12	<.006	3.49	27.2
MZ-1238	3.24	38.2	2.92	.773	.086	2.51	11.6	1.96	.86	.094	1.96	< .10	<.009	2.71	24.2
MZ-1240	5.39	38.8	2.10	.498	.112	1.85	7.9	1.84	2.12	.068	1.62	< .12	<.006	1.06	18.6
MZ-1242	4.91	34.7	2.19	.602	.150	2.01	7.7	1.26	1.53	.123	1.62	.09	.004	1.43	18.8
MZ-1244	3.79	27.6	1.56	.465	.094	1.58	6.2	<1.39	1.91	.029	1.41	.06	<.005	.73	15.9
MB-1245	5.13	51.6	1.93	.571	.126	2.07	7.6	1.61	2.65	.131	1.66	.08	<.006	1.22	21.4
ME-1246	4.93	55.4	2.01	.561	.088	1.95	8.1	1.23	2.20	.164	1.32	< .08	.004	.99	21.0
MB-1247	2.59	19.8	1.14	.334	.086	1.20	5.5	<1.20	2.18	.133	1.02	< .08	.005	.83	11.3
MB-1248	5.56	45.3	1.91	.540	.125	2.36	9.2	2.27	2.66	.167	2.02	.07	<.009	1.13	19.2
ME-1249	4.93	52.8	1.59	.431	.104	2.05	6.1	1.31	4.07	.141	1.48	.09	<.006	1.07	15.7
MB-1250	4.34	41.8	1.37	.400	.125	1.66	6.5	.86	4.46	.112	1.37	.05	.004	1.15	14.7
ME-1251	4.45	41.0	1.60	.402	.093	1.69	6.9	.58	3.86	.115	1.14	< .09	<.005	1.07	15.4
MB-1252	5.57	63.0	1.77	.498	.125	1.96	6.7	2.15	3.65	.153	1.52	< .13	<.006	1.25	17.8

Table A-3b. Elemental analysis, core hole 15/16 (continued).

SAMPLE ID	CS	CU	DY	EU	F	FE	GA	GE	H	HG	HF	IN	IR	K	LA
ANAL.METH.	NAA PPM	XRF PPM	NAA PPM	NAA PPM	SP PERC	NAA PERC	XRF PPM	XRF PPM	COMB PERC	IZAA PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM
APPRCX ERR	.15	1.5	.08	.010	.03*R	.03	.7	.60	.02	.1*R	.05	.10	.004	.20	.5
ME-1253	4.70	49.0	1.73	.530	.132	1.84	7.1	1.94	3.15	.166	1.48	.05	.004	1.08	17.4
ME-1254	4.01	32.9	1.55	.418	.097	1.49	5.5	.86	2.75	.057	1.47	.08	<.005	.76	15.7
ME-1255	4.02	36.8	2.11	.534	.133	1.76	6.6	1.65	2.39	.141	1.68	.13	<.006	1.17	18.1
ME-1256	4.54	33.9	1.87	.530	.100	1.72	7.4	<1.65	1.74	.123	1.55	.05	<.006	1.06	17.3
ME-1257	3.48	26.1	1.72	.482	.093	1.61	6.4	1.33	2.01	.099	1.28	< .10	<.007	.97	16.0
ME-1258	3.89	33.3	1.59	.484	.031	1.57	6.6	.61	2.37	.069	1.54	.07	<.006	.92	16.7
ME-1259	3.39	26.3	1.40	.411	.061	1.54	5.1	.82	2.22	.074	1.26	.11	.003	.98	14.0
ME-1260	3.60	36.4	1.65	.506	.073	1.77	6.4	<1.43	2.08	.187	1.44	< .15	<.007	.92	17.3
ME-1261	4.22	50.7	1.77	.511	.169	2.15	8.3	1.04	3.01	.113	1.56	.12	.008	1.06	18.4
ME-1262	4.03	39.2	1.56	.474	.160	1.82	7.1	1.95	2.80	.166	1.40	.11	<.005	1.06	16.2
ME-1263	1.50	11.0	1.30	.362	.083	1.20	5.7	<1.39	1.68	.034	1.13	.11	.003	.65	12.1
ME-1264	2.54	14.5	1.15	.343	.106	1.08	4.9	<1.72	1.45	.056	1.04	.07	.004	.79	11.0
ME-1265	2.12	14.5	1.45	.364	.095	1.10	5.5	.66	1.67	.072	.98	< .14	<.004	.84	10.8
ME-1266	3.99	21.2	1.54	.468	.093	1.41	6.4	<1.77	1.80	.109	1.05	.04	<.005	.91	14.7
ME-1267	2.61	18.9	1.32	.415	.051	1.19	5.4	.71	1.42	.088	.94	< .12	<.007	.70	12.7
ME-1268	2.20	14.2	1.15	.327	.052	1.00	2.7	<1.28	1.64	.076	.76	< .10	<.004	.93	9.7
ME-1269	2.40	14.6	1.14	.344	.062	1.01	2.5	<1.29	1.82	.085	.83	< .10	<.006	.70	10.5
ME-1270	3.10	17.9	1.29	.379	.043	1.22	4.2	<1.72	2.99	.084	.92	.07	<.006	.76	11.6
MZ-1272	4.30	42.4	1.63	.472	.066	1.74	6.6	1.54	2.77	.109	1.37	.07	<.006	1.15	16.3
MZ-1274	4.12	44.4	1.87	.569	.160	2.11	7.6	.61	2.51	.127	1.48	.07	<.006	1.35	19.1
MZ-1276	4.14	43.7	2.44	.674	.143	2.78	11.1	1.04	1.91	.108	1.33	.11	<.007	1.76	21.8
MZ-1278	3.34	23.3	1.62	.440	.125	1.41	6.3	<1.52	1.58	.080	1.06	.10	<.006	.96	13.5
MZ-1280	4.52	27.1	1.73	.467	.159	1.67	6.7	1.27	1.59	.063	1.48	< .16	<.005	1.23	15.5
MZ-1282	2.75	40.0	1.75	.521	.162	1.81	7.8	1.61	2.02	.144	1.27	.14	<.006	1.58	18.4
MZ-1284	4.40	31.5	2.19	.603	.108	1.96	8.7	.85	1.01	.505	1.45	< .11	.004	1.16	18.5
MZ-1286	3.87	33.0	1.57	.449	.094	1.48	6.1	<1.48	1.34	.063	1.30	< .14	<.006	.96	15.2
MZ-1288	3.68	26.0	1.52	.427	.091	1.58	5.5	<1.14	2.40	.113	1.31	.08	<.005	1.13	16.3
MZ-1289	3.20	22.8	1.37	.409	.091	1.31	5.8	<1.68	1.95	.060	1.00	.11	<.006	.96	13.7
MZ-1292	3.23	18.3	1.50	.487	.061	1.28	5.6	<1.61	1.91	.116	1.08	.05	<.005	1.15	13.1
MZ-1295	4.18	25.4	1.51	.470	.179	1.60	7.0	.98	2.42	.111	1.32	.10	<.006	1.09	15.7
MZ-1300	4.15	22.8	1.54	.450	.170	1.35	6.1	.96	1.55	.050	1.09	.08	<.005	.69	13.5
MZ-1302	3.78	17.0	1.55	.402	.148	1.25	6.1	.67	.96	.042	1.14	< .15	<.005	.86	13.5
MZ-1304	3.25	17.2	1.28	.363	.094	1.15	4.7	<1.43	1.25	.036	.93	.11	.003	.67	12.0
MZ-1306	5.59	42.4	2.56	.671	.217	2.06	8.7	1.30	1.22	.102	1.62	.09	.003	1.32	23.0
MZ-1308	3.86	21.7	2.09	.582	.053	1.82	7.5	1.16	.85	.056	1.44	< .18	<.007	1.16	18.6
MZ-1310	5.71	29.0	1.95	.568	.130	1.94	8.8	.75	1.14	.079	1.47	.16	<.007	1.41	20.8
MZ-1312	5.60	47.0	3.21	.710	.094	2.52	10.7	1.13	1.12	.091	1.40	< .31	<.007	2.47	26.4
MZ-1314	5.99	50.8	3.30	.802	.082	2.94	12.6	.71	.88	.075	1.85	< .26	<.009	2.81	28.0
MZ-1316	4.13	46.9	2.53	.663	.088	2.38	9.4	1.46	1.37	.075	1.59	< .29	<.006	2.29	22.6
MZ-1318	6.65	52.9	3.30	.886	.041	3.35	13.9	1.09	.94	.158	1.65	.64	<.007	2.65	29.3
MZ-1320	4.26	42.9	1.98	.554	.190	2.03	7.1	.71	1.90	.082	1.26	< .38	<.008	1.53	19.5
MZ-1322	4.05	21.8	1.71	.480	.196	1.50	5.4	<1.49	1.52	.089	1.31	< .30	<.005	.85	15.6
MZ-1324	6.27	16.4	2.29	.592	.218	1.78	7.0	.89	.83	.051	1.73	< .51	<.006	1.40	19.5
MZ-1326	8.00	18.0	1.84	.524	.300	1.76	7.4	<1.71	.62	.040	1.24	< .08	.007	1.60	18.5
MZ-1328	7.54	19.9	1.61	.502	.098	1.56	10.4	.83	1.13	.059	1.46	< .10	<.005	1.50	19.6
MZ-1330	4.06	28.2	1.75	.552	.138	1.79	7.7	<1.56	2.06	.091	1.39	.08	.003	1.43	18.0
MZ-1332	3.76	28.7	2.20	.609	.062	2.02	7.6	<1.71	1.87	.069	1.30	.10	<.006	1.71	19.1
MZ-1334	5.58	34.0	2.58	.726	.061	2.36	11.8	.64	1.13	.062	1.97	.09	.007	2.52	28.4

Table A-3b. Elemental analysis, core hole 15/16 (continued).

SAMPLE ID	CS	CU	DY	EU	F	FE	GA	GE	H	HG	HF	IN	IR	K	LA
ANAL.METH.	NAA PPM	XRF PPM	NAA PPM	NAA PPM	SP PERC	NAA PERC	XRF PPM	XRF PPM	COMB PERC	IZAA PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM
APPROX ERR	.15	1.5	.08	.010	.03*R	.03	.7	.60	.02	.1*R	.05	.10	.004	.20	.5
MZ-1336	4.16	17.9	2.13	.568	.165	1.72	6.8	<1.45	.92	.031	1.45	< .14	<.006	1.40	17.1
MZ-1338	2.40	20.0	1.96	.551	.194	1.82	8.3	<1.25	.48	.032	1.46	< .10	<.007	1.45	17.7
MZ-1340	.72	23.0	2.40	.629	.069	1.53	8.7	<1.37	.64	.031	1.53	< .14	<.006	1.76	18.7
MZ-1342	1.78	23.6	2.63	.700	.093	2.33	10.8	<1.83	.66	.047	1.78	< .14	<.008	1.94	22.8
MZ-1344	.57	31.1	3.15	.855	.136	2.72	12.1	1.86	.65	.051	2.68	< .26	.004	2.52	25.2
MZ-1346	9.70	43.7	3.59	.943	.054	3.30	14.7	<1.64	.72	.033	2.36	.20	.005	2.41	30.9
BG-1372	3.43	35.8	3.83	1.025	.131	3.33	14.9	<1.50	.23	.044	2.40	.28	<.007	5.28	32.9
RGS-1377	4.39	36.8	3.08	.774	.225	3.33	16.2	<1.54	.26	.046	2.42	< .28	<.007	5.63	22.1
RGS-1382	1.77	20.5	2.21	.609	.108	2.00	8.7	<1.22	.65	.027	1.47	< .24	<.006	2.93	20.3
RGS-1387	4.18	19.5	1.76	.500	.173	1.71	6.5	<1.41	1.98	.035	1.37	< .27	<.005	1.06	17.6
RGS-1392	5.70	23.8	2.50	.666	.250	2.38	10.7	<1.20	.68	.030	2.22	.17	<.007	2.08	24.2
RGS-1397	4.00	25.9	1.91	.530	.235	1.93	7.9	<1.78	.89	.023	1.46	< .19	.006	1.47	17.8
RGS-1402	4.73	36.3	2.53	.654	.322	2.24	9.8	.64	1.34	.039	1.74	< .29	<.008	1.40	23.1
RGS-1407	2.67	19.3	1.91	.514	.249	1.77	7.9	<1.69	.84	.022	1.27	.14	<.005	1.44	17.6
RGS-1412	4.24	30.0	2.06	.552	.267	2.10	8.9	<1.23	1.14	.035	1.67	< .24	<.006	1.42	20.1
RGS-1417	4.02	30.0	2.15	.620	.243	2.47	9.0	<1.20	1.13	.033	1.57	.07	<.008	2.07	21.4
RGS-1422	2.06	25.4	2.20	.621	.119	2.17	8.9	<1.60	.94	.040	1.67	< .11	<.006	2.93	19.6
RGS-1426	2.35	24.6	2.33	.623	.279	2.29	8.3	<1.60	.62	.034	1.40	.08	<.007	3.49	21.1
RGS-1445	4.81	32.8	2.12	.633	.234	2.23	8.9	<1.55	1.64	.055	1.83	.07	.003	1.63	21.0
RGS-1450	4.55	24.7	1.97	.580	.172	2.02	8.7	<1.57	1.16	.067	1.57	< .12	<.006	1.24	18.5
RGS-1455	4.57	18.7	2.61	.722	.152	2.28	10.5	<1.28	.86	.046	2.10	.05	.005	1.97	23.1
RGS-1460	5.12	28.6	2.22	.620	.224	2.24	8.7	1.04	1.31	.033	1.89	< .13	<.006	1.31	21.0
RGS-1465	5.28	22.6	2.51	.665	.208	2.23	10.9	<1.53	1.16	.058	2.15	< .17	<.009	2.10	22.3
RGS-1468	5.20	48.3	3.61	1.048	.120	3.46	16.7	1.30	.67	.064	2.25	.18	<.008	4.38	34.0
PGS-1518	5.68	29.3	3.10	.849	.194	2.71	13.0	1.65	.64	.067	2.60	.16	<.009	2.54	27.0
PGS-1568	6.01	29.6	3.73	1.023	.164	3.16	14.8	.74	.54	.046	2.97	< .20	<.009	2.86	30.9
PGS-1618	5.83	30.5	2.91	.832	.131	2.59	12.8	<1.61	.85	.058	2.46	< .22	<.007	2.37	27.3
PGS-1668	5.23	21.3	3.48	.950	.178	2.63	14.8	1.29	.39	.030	3.36	< .20	<.011	3.11	29.8
PGS-1718	5.70	21.9	3.38	.894	.101	2.48	13.4	.80	.39	.025	2.78	.26	<.007	3.29	27.1
PGS-1768	5.28	19.8	2.85	.813	.123	2.43	12.6	<1.24	.69	.030	2.61	.54	<.008	2.61	25.6
PGS-1818	4.62	21.9	3.09	.820	.143	2.26	10.0	.78	.74	.034	3.46	.20	<.009	2.11	24.5
PGS-1868	5.43	22.9	2.88	.791	.186	2.27	11.4	<1.36	.75	.038	2.55	.16	.004	1.84	24.3
PGS-1918	5.80	20.9	3.56	.944	.186	2.43	12.9	1.52	.44	.032	3.90	< .26	<.009	2.57	26.9
PGS-1968	5.62	22.1	3.14	.864	.199	2.56	12.7	1.01	.67	.040	2.83	< .28	<.009	2.01	26.2
PGS-2019	4.64	15.2	2.68	.715	.195	1.96	9.8	1.22	.55	.026	2.43	.16	<.009	1.70	22.2

Table A-3c. Elemental analysis, core hole 15/16.

SAMPLE ID	EU	MG	MN	MO	N	NA	ND	NI	PB	RB	S(MIN)	S(ORG)	SB	SC	SE
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	CCMB PERC	NAA PERC	NAA PPM	XRF PPM	XRF PPM	XRF PPM			NAA PPM	NAA PPM	XRF PPM
APPROX ERR	.015	.50	3	1.5	.01	.01	1.5	2.0	1.0	.04*R			.12	.03	.30
LCS- 860	.210	4.54	370	15.7	.31	1.67	15.5	19.8	16.1	67.0			1.34	5.78	1.99
LDS- 865	.237	2.02	407	4.0	.26	1.83	18.2	20.1	12.7	73.4			1.25	6.78	1.16
LDS- 870	.157	2.41	418	9.9	.25	1.99	17.6	19.6	14.4	64.3			1.25	6.51	1.04
LCS- 875	.186	3.45	394	10.3	.39	.96	16.5	20.1	14.2	84.3			1.27	6.45	1.68
LDS- 880	.241	4.20	418	9.1	.38	1.87	21.2	23.2	18.6	98.3			1.83	8.17	1.58
LDS- 885	.212	2.81	413	8.5	.32	1.85	17.4	20.8	16.9	60.4			1.60	5.97	2.21
LCS- 890	.186	4.01	392	10.0	.28	1.93	17.3	20.8	12.9	53.3			1.15	5.44	1.24
LCS- 895	.163	2.79	415	10.5	.28	1.81	17.6	16.7	33.1	58.7			1.12	5.50	1.36
LCS- 900	.178	2.78	388	15.1	.28	1.88	15.6	24.2	16.0	67.4			1.34	5.69	1.21
LCS- 905	.182	3.66	316	17.1	.57	1.52	18.0	19.3	19.9	94.0			1.61	6.53	1.54
LCS- 910	.191	3.34	416	4.8	.40	2.02	21.7	21.3	17.1	79.1			1.62	8.12	1.34
LCS- 915	.149	3.30	404	15.9	.34	1.63	17.7	20.6	16.8	69.4			1.80	6.29	1.51
LDS- 920	.204	4.88	409	15.4	.40	1.87	17.5	23.9	22.0	85.6			1.87	7.10	1.90
LCS- 925	.166	2.79	409	10.9	.57	1.41	19.3	26.1	21.3	92.3			1.82	7.70	3.15
LDS- 930	.180	3.25	444	12.9	.45	1.29	14.9	21.2	15.1	66.6			1.66	5.73	2.18
LDS- 935	.158	2.88	433	15.7	.56	1.22	16.1	25.4	20.3	83.9			1.87	6.45	2.47
LCS- 940	.131	2.21	421	11.5	.35	1.40	13.9	18.9	13.6	58.9			1.55	5.20	2.52
LCS- 945	.101	4.18	446	11.6	.26	1.13	10.5	18.0	8.7	40.3			.92	3.75	1.83
LDS- 950	.104	3.20	426	13.9	.30	1.26	12.3	19.5	10.1	42.4			1.01	3.92	1.59
LCS- 955	.135	3.17	410	11.6	.39	1.33	13.0	17.0	16.8	64.4			1.06	4.84	.75
LDS- 960	.153	2.89	409	13.3	.58	1.17	14.9	19.3	28.7	80.7			1.41	6.46	1.36
LCS- 965	.123	4.12	403	13.1	.35	1.61	12.4	20.4	15.3	54.4			.94	5.12	1.30
LCS- 970	.140	3.23	409	15.3	.56	1.42	16.4	21.1	21.3	67.7			1.38	5.57	1.75
LCS- 975	.145	2.83	386	18.8	.74	1.34	15.2	20.7	25.7	63.7			1.45	5.99	1.95
LCS- 980	.144	3.05	403	14.0	.80	1.04	17.4	21.9	30.4	83.8			1.83	7.59	1.33
LCS- 985	.133	3.86	395	14.2	.55	1.73	15.8	24.8	24.3	64.6			1.51	6.17	1.09
LDS- 990	.178	2.20	400	16.9	.55	1.62	16.7	24.4	24.8	70.0			1.67	6.55	1.44
LCS- 995	.179	3.70	391	10.9	.51	1.48	16.4	23.6	22.6	82.9			1.41	7.31	1.11
LDS-1000	.123	4.34	393	12.0	.34	1.91	14.7	23.0	19.6	57.9			1.27	6.35	1.05
LDS-1005	.167	4.29	376	9.0	.33	2.05	18.7	23.0	21.3	86.9			1.60	7.84	.68
LCS-1010	.188	3.64	312	22.1	.64	1.19	16.0	22.2	26.5	57.9			1.69	6.22	1.99
LDS-1015	.179	3.65	397	10.5	.43	1.95	20.8	24.1	20.7	86.9			1.53	8.79	1.48
LCS-1020	.180	4.08	314	17.4	.42	1.47	14.9	20.8	17.7	62.7			1.22	5.65	1.44
LCS-1025	.172	4.41	348	11.4	.26	2.00	18.6	18.8	16.7	66.8			1.17	6.78	1.34
LCS-1030	.166	3.83	314	19.7	.63	1.00	15.7	23.2	21.4	75.6			1.55	6.12	2.23
LCS-1035	.218	2.80	344	12.6	.70	1.04	20.9	23.4	25.7	100.0			2.11	8.12	1.61
LCS-1040	.200	3.12	283	24.1	.62	1.22	16.7	22.9	23.3	71.4			1.34	5.51	2.02
LDS-1045	.198	4.73	380	10.9	.42	1.21	18.0	20.6	15.3	87.9			1.13	6.37	1.25
LCS-1050	.184	4.27	346	16.5	.31	2.03	15.8	18.7	18.7	55.7			1.47	5.47	2.17
LCS-1055	.156	2.80	359	13.0	.34	1.95	18.3	22.2	21.9	71.1			1.66	6.17	1.90
LDS-1060	.144	3.55	277	26.5	.69	1.18	16.5	23.5	25.3	80.5			1.93	5.85	2.42
LCS-1065	.164	2.70	354	16.4	.65	.39	19.1	22.9	16.8	77.3			1.40	6.69	1.61
LDS-1070	.177	4.61	353	15.9	.80	.57	17.9	19.3	21.3	91.8			1.80	6.23	1.87
LDS-1075	.222	3.48	325	18.2	.63	1.12	19.4	21.6	22.6	77.5			1.95	6.16	2.04
LCS-1080	.222	3.25	376	12.7	.70	.44	23.0	18.6	20.0	77.8			1.74	7.11	2.02
LDS-1085	.154	3.46	333	13.8	.50	1.50	16.6	16.3	20.7	72.7			1.60	5.32	2.47
LCS-1090	.166	3.65	359	9.1	.32	1.74	16.5	15.6	15.0	66.7			1.31	5.38	1.33
LDS-1095	.136	3.93	379	9.6	.33	.95	12.8	15.2	10.2	63.8			.80	3.94	1.12

Table A-3c. Elemental analysis, core hole 15/16 (continued).

SAMPLE ID	LU	MG	MN	MO	N	NA	ND	NI	PB	RB	S(MIN)	S(ORG)	SB	SC	SE
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	COMB PERC	NAA PERC	NAA PPM	XRF PPM	XRF PPM	XRF PPM			NAA PPM	NAA PPM	XRF PPM
APPROX ERR	.015	.50	3	1.5	.01	.01	1.5	2.0	1.0	.04*R			.12	.03	.30
CGS-1100	.129	3.83	373	9.9	.22	1.81	14.6	17.0	13.8	53.3			.99	4.88	1.84
CGS-1105	.129	3.23	369	11.3	.28	1.45	12.5	17.4	13.4	60.6			1.25	4.68	1.40
CGS-1110	.159	2.84	330	14.3	.35	1.61	16.4	19.8	17.0	69.9			1.51	5.06	1.52
CGS-1115	.172	3.40	300	14.3	.44	1.27	16.4	14.6	15.0	69.4			1.31	5.24	2.02
CGS-1120	.149	3.61	323	15.7	.52	.77	12.1	18.8	15.9	80.4			1.37	4.99	1.68
CGS-1125	.136	2.57	300	14.5	.37	1.45	14.4	16.3	14.3	59.0			1.40	4.82	1.65
CGS-1130	.116	4.15	463	8.5	.34	.84	10.1	17.7	8.9	55.9			.88	3.81	1.25
CGS-1135	.169	2.80	317	12.5	.31	2.46	15.8	14.6	18.9	47.6			1.22	4.17	1.75
CGS-1140	.127	3.62	325	9.2	.33	1.32	11.4	16.5	9.3	59.9			1.15	4.43	2.32
CGS-1145	.163	3.09	300	13.9	.41	1.27	11.0	14.2	12.4	53.4			1.72	4.31	2.42
CGS-1150	.156	3.51	289	16.7	.54	1.16	14.6	21.2	15.2	65.3			1.46	5.31	2.19
CGS-1155	.159	4.02	387	8.4	.30	1.61	16.9	15.7	13.6	69.1			1.38	6.24	1.40
CGS-1160	.151	4.16	293	14.5	.29	1.60	14.0	19.7	9.9	52.0			1.15	4.92	1.60
CGS-1165	.178	4.06	373	7.0	.26	1.81	16.3	18.7	15.2	70.1			1.43	6.61	.92
CGS-1170	.143	4.52	299	15.1	.38	1.53	14.3	20.9	13.8	61.8			1.34	5.06	2.04
CGS-1175	.171	4.09	332	16.3	.43	1.60	18.3	22.6	19.1	75.1			1.85	6.66	2.24
CGS-1180	.169	3.15	282	18.5	.52	1.06	14.1	17.0	17.1	68.0			1.91	5.45	2.07
CGS-1185	.150	4.42	356	11.3	.32	1.51	14.0	17.5	11.3	51.2			1.02	4.78	1.33
CGS-1190	.141	4.29	269	25.2	.54	1.49	15.0	19.3	16.4	58.3			1.20	4.88	2.19
CGS-1196	.182	4.06	311	22.6	.61	1.09	16.9	20.5	21.4	73.4			1.46	6.07	1.66
CGS-1205	.263	5.17	386	8.3	.48	.44	21.7	20.7	17.3	83.6			1.39	8.21	.81
CGS-1208	.241	3.31	383	8.9	.50	.45	24.0	24.1	21.7	77.5			1.97	7.92	1.02
MZ-1210	.207	5.14	362	10.7	.71	.48	20.6	17.9	17.2	87.5			1.62	8.42	1.01
MZ-1212	.151	5.70	257	27.1	.30	1.53	16.4	19.3	18.4	81.7			1.19	5.52	.58
MZ-1214	.128	4.69	237	27.5	.51	1.68	15.3	21.1	25.9	91.0			1.60	5.05	2.14
MZ-1216	.160	4.21	310	22.8	.36	1.84	20.8	22.8	21.9	86.4			1.32	5.78	2.23
MZ-1218	.150	5.46	270	34.5	.28	2.39	17.7	18.1	16.2	64.8			1.04	4.99	1.12
MZ-1220	.155	2.89	291	53.7	.58	2.09	19.7	26.0	35.5	79.6			3.06	6.14	3.59
MZ-1222	.125	4.06	260	32.9	.45	1.79	15.4	18.5	23.1	58.6			2.42	5.32	2.91
MZ-1224	.158	3.10	266	40.5	.77	1.70	16.1	20.3	29.5	60.0			2.16	5.86	3.26
MZ-1226	.188	2.47	291	17.7	.54	1.66	15.0	14.0	12.4	57.6			1.17	5.14	1.79
MZ-1228	.155	2.26	371	14.2	.53	1.58	19.3	17.8	16.3	79.0			1.78	6.59	1.13
MZ-1230	.212	3.18	358	12.4	.36	1.89	18.5	22.2	19.7	71.5			1.77	7.06	1.64
MZ-1232	.192	3.79	351	11.4	.43	1.59	16.2	15.8	12.5	60.1			1.55	5.64	2.15
MZ-1234	.338	3.46	362	9.9	.54	1.62	24.2	17.6	15.1	84.0			1.70	7.39	1.28
MZ-1236	.339	3.73	364	11.9	.69	1.07	24.0	20.7	23.4	97.6			2.21	8.22	1.18
MZ-1238	.249	3.53	381	14.3	.67	.96	21.5	22.0	22.0	91.6			2.06	8.13	1.58
MZ-1240	.153	3.54	261	40.2	.66	1.48	16.6	23.5	26.1	61.5			2.33	5.20	2.75
MZ-1242	.179	2.99	355	21.8	.45	1.75	16.0	18.7	23.2	68.1			2.37	5.97	2.64
MZ-1244	.092	3.90	271	21.9	.48	1.68	13.8	20.2	25.7	51.1			2.34	4.52	2.15
MB-1245	.158	3.12	280	43.1	.66	1.99	16.2	27.0	36.8	66.7			5.23	5.67	4.66
MB-1246	.155	2.89	325	39.5	.58	1.53	15.2	26.8	32.8	60.9			4.52	5.32	4.77
MB-1247	.081	3.47	254	28.4	.68	.89	9.0	20.6	10.2	40.4			1.10	3.26	4.48
MB-1248	.137	3.24	230	33.9	.87	1.72	16.9	26.3	34.4	69.6			2.11	6.04	2.90
MB-1249	.134	2.21	190	32.6	1.23	1.48	12.0	23.4	37.0	58.6			2.68	4.74	2.09
MB-1250	.099	2.40	212	31.2	1.11	1.58	11.0	21.0	30.7	49.6			1.94	4.20	2.35
MB-1251	.119	2.27	205	25.3	1.10	1.86	10.6	22.8	32.0	57.4			2.67	4.41	2.76
MB-1252	.140	1.96	238	47.0	1.08	2.04	13.4	27.3	41.4	58.8			3.74	5.63	3.94

Table A-3c. Elemental analysis, core hole 15/16 (continued).

SAMPLE ID	LU	MG	MN	MO	N	NA	ND	NI	PB	RB	S(MIN)	S(ORG)	SB	SC	SE
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	COMB PERC	NAA PERC	NAA PPM	XRF PPM	XRF PPM	XRF PPM			NAA PPM	NAA PPM	XRF PPM
APPROX LMR	.015	.50	3	1.5	.01	.01	1.5	2.0	1.0	.0498			.12	.03	.30
MB-1253	.149	1.76	279	34.2	.91	1.52	14.6	22.1	32.7	62.5			3.56	5.09	4.77
MB-1254	.100	3.54	239	36.6	.77	1.28	13.0	18.1	26.9	58.6			2.20	4.53	2.25
MB-1255	.155	3.05	258	33.6	.77	1.49	14.9	19.2	24.2	57.2			2.89	5.11	3.72
MB-1256	.148	2.55	266	19.2	.56	1.50	14.9	25.1	18.5	55.3			2.03	5.20	3.66
MB-1257	.166	2.83	287	21.3	.59	1.30	11.7	20.7	16.9	51.6			2.00	4.71	2.86
MB-1258	.116	3.62	273	26.4	.74	1.18	14.1	21.3	21.9	59.2			2.63	4.68	3.86
MB-1259	.092	4.01	261	20.1	.66	1.11	11.1	19.8	18.1	50.1			2.08	4.36	3.69
MB-1260	.125	3.03	303	25.5	.63	1.35	12.6	23.5	20.3	52.7			3.03	4.68	4.48
MB-1261	.159	2.15	272	29.2	.88	1.52	13.6	22.7	36.3	62.9			3.70	5.34	4.46
MB-1262	.136	2.42	284	27.2	.89	1.22	12.3	25.2	24.4	58.6			2.55	4.60	4.62
MB-1263	.107	4.62	332	5.4	.55	1.25	10.0	13.1	7.3	37.6			1.01	3.65	1.50
MB-1264	.104	3.17	316	9.5	.46	1.19	9.0	13.7	5.8	32.4			1.23	3.30	2.61
MB-1265	.093	2.00	301	10.6	.34	1.09	9.0	15.7	6.8	43.5			1.31	3.37	3.18
MB-1266	.115	3.15	282	14.0	.53	1.44	12.9	18.5	12.5	48.6			1.60	4.34	4.29
MB-1267	.115	2.21	302	12.9	.37	1.30	10.3	15.4	8.7	36.6			1.42	3.65	2.43
MB-1268	.088	2.67	276	12.7	.52	.96	7.9	14.3	8.6	38.8			.99	3.02	2.82
MB-1269	.092	2.07	246	14.3	.61	1.07	8.2	13.5	5.0	35.7			.69	2.99	3.68
MB-1270	.077	2.30	248	15.3	1.04	1.21	9.8	15.0	8.3	39.9			.90	3.49	2.28
MZ-1272	.125	2.55	257	29.2	.59	1.33	11.6	24.9	28.3	57.9			2.41	4.63	4.30
MZ-1274	.177	2.92	259	27.7	.82	1.83	13.8	28.1	31.8	67.2			2.84	5.46	3.55
MZ-1276	.174	2.57	303	21.2	.70	1.99	18.9	21.6	35.6	70.1			2.04	7.48	2.10
MZ-1278	.126	2.56	275	17.9	.54	1.48	11.0	19.3	10.7	45.9			1.06	4.08	2.51
MZ-1280	.124	4.72	260	23.2	.50	1.59	13.4	18.8	17.9	64.3			1.44	4.89	1.55
MZ-1282	.149	2.66	245	31.3	.76	1.31	14.7	26.8	29.4	72.6			2.94	5.04	3.47
MZ-1284	.182	3.72	282	19.5	.42	1.88	16.5	19.6	19.9	63.9			2.23	6.10	2.24
MZ-1286	.124	4.52	237	24.6	.50	1.42	11.6	20.8	25.6	62.1			1.25	4.56	2.73
MZ-1288	.131	3.86	224	32.7	.76	1.34	13.5	18.4	15.4	64.7			1.86	4.58	1.34
MZ-1289	.104	2.74	258	23.7	.63	1.51	10.3	14.1	12.6	56.8			1.19	4.09	1.84
MZ-1292	.126	2.21	246	17.9	.65	1.34	11.3	16.1	10.5	51.0			1.20	3.86	2.84
MZ-1295	.133	3.37	226	30.4	.76	1.61	11.3	19.7	16.8	56.6			1.41	4.59	2.80
MZ-1300	.126	3.52	254	19.3	.52	1.54	11.3	15.3	14.2	51.8			1.19	4.33	1.30
MZ-1302	.127	3.59	254	14.3	.31	1.39	11.6	15.5	8.0	56.4			.80	3.97	.79
MZ-1304	.101	4.32	247	14.3	.38	1.26	10.9	15.3	8.3	47.8			.49	3.61	.67
MZ-1306	.157	3.22	260	29.2	.42	2.05	16.9	22.7	23.1	68.0			1.89	6.13	2.34
MZ-1308	.151	4.62	304	15.7	.32	1.75	15.9	15.7	14.2	68.7			.87	5.49	1.21
MZ-1310	.165	5.03	256	29.7	.45	1.93	18.8	18.5	24.7	80.3			.94	5.80	1.66
MZ-1312	.253	3.35	299	29.9	.58	1.88	21.2	21.9	34.8	106.0			1.80	8.11	1.85
MZ-1314	.289	4.07	327	21.7	.52	2.22	25.0	24.2	38.5	105.0			1.97	8.94	2.22
MZ-1316	.167	3.68	267	37.0	.74	1.41	18.9	21.7	29.7	77.6			2.30	6.48	2.01
MZ-1318	.264	3.66	363	25.5	.69	1.90	25.3	31.2	40.6	93.2			2.38	5.32	2.02
MZ-1320	.165	3.14	249	39.0	.88	1.41	16.0	21.7	27.8	69.1			2.49	5.35	2.40
MZ-1322	.141	2.85	209	24.2	.49	1.47	12.6	15.6	10.6	56.9			1.00	4.22	2.32
MZ-1324	.171	3.30	282	13.8	.35	1.62	15.9	11.1	11.6	72.7			.54	5.59	.75
MZ-1326	.158	4.65	263	23.2	.45	1.18	15.0	14.5	12.6	74.5			.74	5.45	1.13
MZ-1328	.125	3.64	229	36.7	.50	1.91	15.2	15.7	19.5	76.4			1.34	4.45	1.13
MZ-1330	.123	3.50	242	28.5	.85	1.22	13.8	18.1	16.0	67.3			1.40	5.12	2.17
MZ-1332	.167	2.94	261	22.1	.78	1.35	17.1	18.4	16.7	64.0			1.08	5.85	1.79
MZ-1334	.179	2.10	312	19.5	.73	1.64	21.1	19.5	21.3	82.2			1.10	6.32	1.66

Table A-3c. Elemental analysis, core hole 15/16 (continued).

SAMPLE ID	LU	MG	MN	MO	N	NA	ND	NI	PB	RB	S(MIN)	S(ORG)	SB	SC	SE
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	COMB PERC	NAA PERC	NAA PPM	XRF PPM	XRF PPM	XRF PPM			NAA PPM	NAA PPM	XRF PPM
APPROX ERR	.015	.50	3	1.5	.01	.01	1.5	2.0	1.0	.04*R			.12	.03	.30
MZ-1336	.190	4.47	274	16.4	.42	1.36	14.5	16.6	10.7	61.3			.64	5.46	.58
MZ-1338	.154	5.44	298	13.9	.33	1.40	14.2	15.5	9.9	68.3			.74	5.51	1.11
MZ-1340	.180	3.92	309	16.6	.35	1.64	17.3	21.4	11.5	62.4			.72	5.99	.68
MZ-1342	.203	3.89	322	18.8	.39	1.74	19.7	15.2	13.0	83.6			.98	7.35	.65
MZ-1344	.262	1.68	306	17.5	.37	2.70	22.2	30.4	19.5	86.4			2.23	9.00	1.95
MZ-1346	.279	3.41	345	17.5	.38	3.12	27.6	26.1	29.5	78.5			2.74	9.96	1.10
BC-1372	.330	3.39	405	13.0	.22	2.01	28.7	28.3	21.6	116.0			1.65	10.77	1.07
RCS-1377	.234	2.72	396	6.3	.15	1.73	17.2	24.0	24.5	124.0			1.90	9.47	1.00
ROS-1382	.185	4.63	252	19.0	.27	2.35	18.1	19.7	11.8	72.8			.68	7.07	.67
ROS-1387	.124	2.58	204	27.7	.63	1.40	14.0	19.1	16.1	68.5			.83	4.68	1.03
RCS-1392	.209	4.78	308	19.1	.20	2.31	19.5	16.5	16.4	95.3			.82	6.92	.99
RGS-1397	.134	5.78	250	21.6	.32	2.18	15.1	18.2	18.1	74.7			.54	5.28	1.42
ROS-1402	.161	3.91	266	19.5	.46	2.74	18.1	22.2	27.5	79.7			.80	6.20	1.91
ROS-1407	.183	4.62	249	20.0	.30	2.62	14.2	18.8	14.0	71.1			.54	5.11	.65
ROS-1412	.137	3.63	216	36.1	.40	2.07	15.7	23.2	25.2	75.4			.94	5.31	2.29
ROS-1417	.169	3.52	281	31.3	.46	2.00	17.7	24.4	22.1	84.8			.56	6.23	1.26
ROS-1422	.182	3.29	276	19.6	.53	1.09	18.1	17.6	20.4	78.8			.58	6.03	.88
ROS-1426	.163	4.68	307	16.8	.43	.71	18.6	19.3	17.9	96.4			.70	6.36	.51
ROS-1445	.182	4.57	232	29.8	.57	1.40	17.8	22.5	24.5	80.9			1.07	6.19	1.16
RCS-1450	.145	4.83	235	25.4	.39	1.37	14.9	18.8	17.6	74.1			.96	5.90	1.18
ROS-1455	.164	4.72	328	18.0	.29	1.48	20.7	23.3	12.9	83.9			.74	7.16	1.13
RCS-1460	.171	5.17	289	26.2	.40	1.42	18.2	18.9	15.0	85.0			1.06	6.69	1.61
ROS-1465	.174	4.22	351	22.2	.43	1.47	17.9	24.6	15.6	86.6			1.18	7.16	1.19
RGS-1468	.249	3.21	417	11.3	.50	1.53	30.4	31.5	24.9	97.9			1.79	12.31	.83
POS-1518	.222	3.37	367	13.6	.30	1.81	24.4	22.8	17.8	89.0			1.19	8.63	1.29
FCS-1568	.296	2.62	407	11.9	.26	2.26	27.8	24.8	19.3	96.4			1.82	10.28	.96
POS-1618	.229	2.94	393	11.8	.31	2.11	23.9	23.7	20.3	94.4			1.62	8.64	.73
POS-1668	.300	3.10	404	5.4	.19	2.07	25.8	22.6	13.0	101.0			.68	9.19	.50
POS-1718	.216	3.53	376	6.5	.17	2.11	25.5	21.1	14.5	98.1			.98	8.97	.27
FCS-1768	.221	4.16	362	10.4	.26	2.15	21.3	21.8	14.6	91.3			1.00	8.38	.52
POS-1818	.243	2.25	421	5.9	.25	2.12	21.2	20.1	11.2	74.8			1.57	7.86	.30
POS-1868	.238	3.13	368	7.0	.27	1.95	21.3	22.3	13.7	81.4			1.46	8.05	.28
FCS-1918	.277	2.42	357	4.3	.23	1.74	25.3	20.6	13.6	96.5			1.33	8.94	.64
POS-1968	.259	3.67	348	7.0	.27	1.56	22.9	24.6	13.7	86.6			1.21	8.80	1.16
POS-2019	.230	3.75	398	5.7	.20	1.18	19.4	18.9	9.2	71.1			.94	6.85	.35

Table A-3d. Elemental analysis, core hole 15/16.

SAMPLE ID	SM	SN	SR	TA	TB	TH	TI	U	V	W	Y	YB	ZN	ZR
ANAL.METH.	NAA PPM	NAA PPM	XRF PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM	NAA PPM	XRF PPA	NAA PPM	XRF PPM	XRF PPM
APPRCX ERR	.01	50	.04*R	.004	.020	.05	.020	.03	15	.30	.6	.03	.C4*R	2.0
COS- 860	2.76	50	810.	.479	.323	6.47	.197	3.51	61	1.14	12.6	1.20	62.7	38.2
COS- 865	3.19	< 126	716.	.477	.383	9.17	.110	3.44	66	1.36	14.8	1.74	67.8	40.4
COS- 870	3.18	< 1C7	700.	.525	.423	6.86	.158	2.79	64	1.14	16.0	1.44	70.9	36.6
COS- 875	2.70	77	722.	.460	.305	7.93	.107	2.89	44	1.30	12.2	1.30	65.6	33.1
COS- 880	3.65	60	510.	.678	.461	8.51	.192	2.94	76	1.42	19.1	1.78	79.7	51.1
COS- 885	3.00	52	755.	.510	.382	8.09	.136	3.75	51	.57	14.3	1.41	63.1	42.8
COS- 890	3.03	< 115	686.	.526	.388	7.89	.093	3.17	66	1.23	15.2	1.40	57.9	30.2
COS- 895	2.77	< 113	784.	.476	.301	6.55	.142	3.45	79	.96	12.0	1.23	153.0	35.5
COS- 900	2.68	50	699.	.469	.299	6.53	.150	4.19	110	.59	10.4	1.13	63.9	42.9
COS- 905	2.92	49	679.	.463	.368	6.25	.169	3.61	102	1.27	12.1	1.28	77.1	53.1
COS- 910	3.55	< 130	613.	.517	.422	7.38	.165	2.55	76	1.28	16.3	1.60	77.5	55.1
COS- 915	2.86	68	736.	.468	.348	6.41	.143	3.56	104	.84	12.6	1.32	71.6	47.8
COS- 920	2.95	< 108	543.	.475	.336	6.02	.136	3.45	89	1.32	11.4	1.22	75.0	47.0
COS- 925	3.26	85	630.	.495	.400	6.62	.140	2.77	92	1.34	12.6	1.42	82.7	48.0
COS- 930	2.52	< 90	813.	.397	.289	5.68	.123	2.88	84	1.07	10.8	1.11	67.3	39.0
COS- 935	2.74	< 121	693.	.418	.330	5.70	.145	2.99	80	1.68	10.6	1.15	74.4	43.2
COS- 940	2.32	50	859.	.352	.271	4.92	.125	2.27	83	1.21	9.9	1.04	62.6	35.5
COS- 945	1.78	38	1030.	.301	.222	4.04	.102	2.25	76	1.15	8.1	.86	43.1	29.1
COS- 950	1.86	39	995.	.293	.210	3.93	.094	2.48	29	.95	6.8	.79	43.9	30.8
COS- 955	1.96	< 1C2	800.	.355	.213	4.27	.109	2.77	73	1.65	7.9	.89	57.7	34.2
COS- 960	2.56	59	647.	.496	.296	5.62	.155	2.79	83	2.56	8.8	1.11	65.3	40.0
COS- 965	2.13	< 80	786.	.359	.239	4.36	.134	3.09	86	1.79	7.6	.94	55.7	39.3
COS- 970	2.58	63	685.	.428	.272	5.39	.122	3.65	103	2.12	8.8	1.08	57.5	38.2
COS- 975	2.56	75	611.	.417	.324	5.39	.121	4.33	107	2.61	8.0	1.11	63.1	35.3
COS- 980	2.87	< 91	552.	.494	.357	6.28	.196	3.39	140	2.65	10.6	1.24	69.9	37.2
COS- 985	2.65	< 128	720.	.434	.302	5.75	.161	4.06	100	2.42	10.2	1.19	60.2	45.1
COS- 990	2.81	50	666.	.455	.338	5.82	.173	3.82	100	1.77	9.9	1.18	65.2	45.6
COS- 995	2.74	50	550.	.476	.327	6.14	.151	3.15	106	2.02	11.8	1.23	68.5	55.0
COS-1000	2.48	53	601.	.441	.306	5.92	.170	3.73	67	1.58	11.0	1.12	60.2	56.4
COS-1005	3.C9	< 136	544.	.512	.347	6.34	.175	3.01	93	1.41	12.6	1.30	70.6	64.2
COS-1010	2.61	< 124	615.	.418	.299	6.36	.163	4.94	79	1.74	9.6	1.18	73.9	47.9
COS-1015	3.45	< 129	519.	.521	.381	6.82	.197	2.87	89	2.06	14.2	1.39	85.1	54.0
COS-1C20	2.64	144	747.	.398	.313	6.31	.140	4.94	67	1.51	10.9	1.31	66.3	44.6
COS-1025	3.04	< 103	625.	.461	.368	6.86	.178	2.91	79	1.25	13.0	1.29	71.9	50.3
COS-1030	2.67	103	659.	.426	.326	6.62	.189	4.57	94	.36	9.4	1.25	69.9	40.7
COS-1C35	3.55	72	553.	.560	.453	6.80	.208	3.45	86	2.12	14.0	1.46	88.5	55.1
COS-1040	2.53	< 89	746.	.431	.426	7.12	.104	4.85	96	.83	11.8	1.49	69.0	39.1
COS-1045	3.10	65	678.	.471	.384	7.33	.173	2.50	75	1.44	15.2	1.41	65.4	52.8
COS-1050	2.65	95	791.	.461	.343	6.09	.135	4.10	85	1.44	10.8	1.17	63.6	55.4
COS-1055	3.02	53	686.	.513	.385	6.91	.198	4.00	82	1.18	12.7	1.30	68.0	44.5
COS-1C60	2.67	44	672.	.443	.317	6.21	.118	4.91	88	.73	10.4	1.15	66.1	37.1
COS-1065	3.C4	70	674.	.528	.363	6.58	.180	3.44	95	.14	12.1	1.37	66.8	34.4
COS-1C70	2.89	58	568.	.587	.366	5.75	.163	4.25	85	1.18	11.5	1.32	70.5	38.4
COS-1C75	3.12	53	608.	.599	.410	7.86	.161	4.25	69	1.90	12.9	1.52	68.0	38.5
COS-1C80	3.53	< 121	515.	.575	.446	8.45	.263	3.59	91	3.43	13.9	1.51	72.3	37.5
COS-1C85	2.79	54	608.	.544	.359	6.99	.104	3.45	73	1.22	10.5	1.17	61.9	45.4
COS-1C90	2.67	102	698.	.451	.338	6.21	.143	2.46	63	1.36	10.7	1.13	56.4	44.2
COS-1C95	1.97	< 93	828.	.348	.238	4.58	.118	2.23	58	1.18	7.7	.84	44.2	36.2

Table A-3d. Elemental analysis, core hole 15/16 (continued).

SAMPLE ID	SM	SN	SR	TA	TB	TH	TI	U	V	W	Y	YB	ZN	ZR
ANAL.METH.	NAA PPM	NAA PPM	XRF PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM	NAA PPM	XRF PPM	NAA PPM	XRF PPM	XRF PPM
APPROX ERR	.01	50	.04*R	.004	.020	.05	.020	.03	15	.30	.6	.03	.04*R	2.0
CCS-1100	2.43	< 80	793.	.403	.340	6.13	.124	2.93	59	.89	10.7	1.17	49.7	44.6
CCS-1105	2.22	54	825.	.366	.300	5.32	.163	3.33	85	1.37	8.6	1.00	50.9	38.9
CCS-1110	2.68	< 111	754.	.437	.338	6.31	.106	3.66	74	3.93	11.0	1.15	54.5	35.7
CCS-1115	2.61	105	853.	.395	.316	6.39	.143	3.58	76	.72	10.4	1.21	51.3	30.7
CCS-1120	2.52	51	781.	.387	.312	5.91	.126	3.25	63	1.33	10.5	1.10	51.4	30.9
CCS-1125	2.42	81	916.	.368	.320	6.21	.108	2.93	59	.74	10.1	1.17	49.2	30.9
CCS-1130	1.92	49	870.	.334	.252	5.46	.211	2.43	43	2.81	7.0	.80	41.9	21.6
CCS-1135	2.72	< 113	724.	.620	.343	10.63	.118	3.59	66	1.29	11.8	1.17	56.8	33.9
CCS-1140	2.09	42	956.	.324	.262	4.34	.106	2.81	69	1.25	8.1	.97	51.2	30.7
CCS-1145	2.03	55	962.	.319	.230	4.37	.112	3.22	71	0.00	7.6	.97	58.3	27.3
CCS-1150	2.54	< 115	908.	.387	.322	5.66	.115	3.64	78	1.14	10.2	1.16	71.8	28.0
CCS-1155	2.86	97	822.	.395	.356	6.48	.179	2.46	57	1.77	11.6	1.20	64.0	31.4
CCS-1160	2.27	92	966.	.340	.289	5.20	.171	3.86	59	1.56	9.2	1.05	55.1	31.9
CCS-1165	2.80	63	696.	.414	.341	6.45	.161	2.42	93	.89	12.3	1.22	67.3	41.9
CCS-1170	2.30	48	930.	.339	.289	4.99	.159	3.49	61	1.46	9.5	1.02	59.7	39.5
CCS-1175	3.00	< 119	709.	.417	.345	6.46	.181	3.81	104	1.03	12.4	1.30	73.8	45.5
CCS-1180	2.55	< 117	879.	.352	.354	5.56	.150	3.13	92	.56	9.0	1.09	60.0	36.2
CCS-1185	2.45	104	915.	.357	.269	5.25	.139	3.33	81	1.21	9.3	1.00	55.6	42.6
CCS-1190	2.36	< 119	846.	.377	.274	4.94	.125	4.94	98	1.25	8.3	.98	62.8	39.6
CCS-1196	2.87	< 118	748.	.404	.354	6.30	.159	4.58	95	1.32	10.9	1.22	87.6	34.9
CCS-1205	3.50	97	610.	.540	.399	7.62	.224	3.33	103	1.56	14.8	1.60	73.7	43.0
CCS-1208	3.93	60	351.	.691	.499	7.75	.217	3.07	121	1.55	15.4	1.73	88.9	56.4
MZ-1210	3.30	65	556.	.539	.354	8.20	.206	3.38	111	1.90	14.1	1.56	102.0	37.2
MZ-1212	2.50	96	698.	.434	.267	5.99	.192	3.77	107	1.51	9.0	1.13	75.7	33.6
MZ-1214	2.47	45	741.	.422	.291	5.76	.174	4.33	105	.84	8.0	1.04	86.3	35.1
MZ-1216	3.12	122	728.	.478	.351	8.17	.161	4.49	79	1.82	12.0	1.31	79.5	31.7
MZ-1218	2.75	89	917.	.565	.274	7.24	.180	4.34	83	1.57	8.4	1.02	63.8	59.8
MZ-1220	3.08	88	548.	.573	.310	8.22	.207	5.31	127	2.88	8.1	1.14	111.0	46.5
MZ-1222	2.63	56	907.	.378	.283	5.36	.120	4.56	101	2.18	8.5	1.11	87.3	25.9
MZ-1224	2.61	50	563.	.419	.304	5.43	.114	6.84	145	1.54	7.4	1.20	92.6	26.0
MZ-1226	2.58	64	867.	.400	.296	6.08	.105	3.91	70	1.73	8.9	1.20	73.5	36.3
MZ-1228	3.21	107	718.	.452	.400	7.56	.159	3.48	88	1.13	13.2	1.48	54.9	46.8
MZ-1230	3.26	72	726.	.444	.391	6.82	.188	3.27	71	.51	14.0	1.51	101.0	39.5
MZ-1232	2.76	44	788.	.410	.326	6.07	.123	4.29	85	1.16	11.1	1.29	61.4	34.6
MZ-1234	4.29	83	515.	.608	.580	8.01	.127	4.29	75	1.84	23.1	2.48	77.9	45.5
MZ-1236	4.27	< 118	500.	.595	.572	8.52	.202	4.36	108	2.23	21.3	2.27	51.9	48.2
MZ-1238	3.72	58	633.	.539	.465	7.77	.218	4.43	136	1.23	15.8	1.64	83.2	58.0
MZ-1240	2.61	45	676.	.392	.302	5.21	.149	6.03	121	1.72	9.1	1.28	79.0	24.5
MZ-1242	2.84	41	724.	.409	.332	6.32	.169	3.83	112	1.52	10.7	1.28	76.3	34.7
MZ-1244	2.11	55	669.	.363	.213	4.66	.095	4.38	127	1.74	6.1	.83	71.8	21.3
ME-1245	2.60	77	525.	.421	.261	5.58	.122	5.26	150	3.43	7.1	1.10	52.4	33.5
ME-1246	2.64	56	674.	.356	.317	5.43	.110	4.71	119	1.86	7.8	1.05	84.2	24.7
ME-1247	1.49	34	837.	.254	.174	3.16	.032	4.28	86	2.10	4.2	.62	67.3	26.9
ME-1248	2.59	91	464.	.414	.258	5.53	.157	8.18	175	6.34	6.8	1.10	80.6	50.2
ME-1249	2.02	83	257.	.357	.244	4.49	.098	3.90	184	4.60	2.4	.81	73.2	17.1
ME-1250	1.83	< 87	306.	.339	.230	3.97	.090	3.59	167	4.55	1.7	.77	76.6	15.6
ME-1251	1.93	52	327.	.339	.226	4.11	.095	3.40	164	6.59	2.7	.84	76.2	19.9
ME-1252	2.30	72	284.	.379	.251	4.97	.125	4.04	203	11.16	5.2	1.00	56.6	28.6

Table A-3d. Elemental analysis, core hole 15/16 (continued).

SAMPLE ID	SM	SN	SR	TA	TB	TH	TI	U	V	W	Y	YB	ZN	ZR
ANAL.METH.	NAA PPM	NAA PPM	XRF PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM	NAA PPM	XRF PPM	NAA PPM	XRF PPM	XRF PPM
APPROX ERR	.01	50	.04*R	.004	.020	.05	.020	.03	15	.30	.6	.03	.04*R	2.0
MB-1253	2.36	57	500.	.361	.273	4.83	.084	4.18	132	4.02	5.1	.94	84.6	35.0
MB-1254	2.00	56	521.	.340	.221	3.88	.104	3.92	132	5.12	5.1	.84	67.1	37.7
MB-1255	2.59	56	648.	.374	.308	4.96	.154	3.84	122	5.87	8.8	1.15	76.6	35.0
MB-1256	2.56	< 116	936.	.354	.325	5.41	.144	3.29	95	1.77	8.9	1.09	73.5	35.6
MB-1257	2.26	54	890.	.309	.276	5.09	.129	3.07	77	1.28	8.3	.96	65.0	30.0
MB-1258	2.27	< 109	573.	.344	.255	4.31	.111	4.15	97	2.20	5.3	.91	65.3	28.1
MB-1259	1.57	46	697.	.303	.245	3.66	.094	3.39	88	3.29	5.3	.82	62.4	23.2
MB-1260	2.37	58	799.	.327	.276	4.68	.127	2.95	87	1.81	7.9	.93	66.2	26.9
MB-1261	2.42	124	459.	.382	.270	5.03	.145	5.64	161	2.30	5.8	1.03	78.7	33.8
MB-1262	2.11	43	578.	.338	.230	4.26	.125	5.08	110	1.62	5.8	.87	70.1	24.1
MB-1263	1.72	55	801.	.286	.219	3.41	.075	1.96	85	2.20	6.1	.70	43.0	18.2
MB-1264	1.61	38	897.	.251	.202	3.11	.073	1.83	60	2.14	6.1	.70	37.9	22.7
MB-1265	1.72	44	1200.	.261	.177	3.43	.106	2.08	59	2.19	6.2	.73	42.6	23.3
MB-1266	2.10	< 103	998.	.329	.258	4.23	.060	2.37	87	2.82	6.7	.91	55.0	23.1
MB-1267	1.90	50	1200.	.278	.198	3.88	.063	2.05	71	2.39	6.7	.78	43.8	17.8
MB-1268	1.52	< 87	1320.	.237	.146	3.07	.036	2.13	61	1.54	4.3	.63	60.3	17.9
MB-1269	1.53	39	1440.	.242	.188	3.12	.006	2.30	65	1.72	4.9	.67	53.7	13.3
MB-1270	1.72	58	1250.	.269	.202	3.48	.114	2.84	67	1.67	6.7	.72	57.2	18.3
MZ-1272	2.15	45	621.	.342	.271	4.41	.113	4.80	105	2.42	5.3	.90	81.6	23.5
MZ-1274	2.55	82	573.	.379	.286	5.57	.117	4.22	126	1.98	6.7	1.00	78.2	30.9
MZ-1276	3.16	62	608.	.456	.351	6.74	.186	4.16	156	1.99	10.5	1.35	69.6	34.9
MZ-1278	2.08	52	1100.	.296	.260	4.39	.125	3.30	44	1.17	8.8	.88	54.1	26.9
MZ-1280	2.21	< 85	696.	.351	.233	4.53	.153	4.00	100	1.35	7.1	.93	60.0	32.9
MZ-1282	2.36	< 103	680.	.394	.266	4.96	.137	4.48	121	1.03	6.7	.95	76.9	31.7
MZ-1284	2.90	82	812.	.387	.339	6.15	.149	3.19	100	2.22	12.4	1.26	66.4	39.3
MZ-1286	2.09	< 54	671.	.331	.265	4.46	.091	3.83	78	1.83	5.4	.89	61.3	23.9
MZ-1288	2.07	56	774.	.331	.224	4.41	.084	5.18	123	3.58	7.6	.88	57.0	31.7
MZ-1289	1.95	< 94	978.	.308	.199	4.17	.112	2.55	100	2.16	6.0	.77	57.3	19.6
MZ-1292	1.51	39	1120.	.292	.198	3.74	.096	2.55	76	1.28	6.1	.81	54.3	17.5
MZ-1295	2.06	< 104	756.	.341	.212	4.26	.092	4.23	101	.69	4.9	.83	60.3	19.4
MZ-1300	2.12	52	1110.	.302	.251	4.39	.072	2.80	68	1.55	7.1	.84	57.9	12.5
MZ-1302	2.05	61	1260.	.291	.220	3.99	.109	2.66	42	2.59	8.1	.80	47.2	26.7
MZ-1304	1.77	73	1200.	.339	.220	3.83	.082	3.34	69	2.97	5.6	.73	45.4	21.9
MZ-1306	3.14	51	988.	.429	.410	6.82	.148	4.46	106	.67	12.5	1.31	75.2	23.9
MZ-1308	2.81	64	933.	.397	.367	5.41	.111	3.77	73	1.30	12.0	1.24	61.5	16.7
MZ-1310	2.75	48	783.	.461	.310	5.78	.141	5.17	92	1.32	8.9	1.10	71.6	33.8
MZ-1312	3.84	< 102	671.	.511	.521	7.15	.168	5.99	129	3.07	17.7	1.84	88.9	36.5
MZ-1314	4.11	< 143	568.	.590	.516	8.50	.163	4.47	155	.82	18.0	1.99	57.4	43.0
MZ-1316	3.14	< 120	902.	.449	.360	7.41	.153	6.72	127	3.07	11.8	1.38	82.8	27.2
MZ-1318	4.22	120	593.	.599	.551	8.86	.231	5.14	147	.42	17.9	1.87	104.0	39.8
MZ-1320	2.64	67	870.	.414	.297	6.11	.139	5.95	116	2.61	8.1	1.16	73.6	22.1
MZ-1322	2.30	49	1280.	.337	.277	4.88	.063	4.03	83	3.90	9.0	.90	53.0	37.2
MZ-1324	2.86	55	890.	.435	.348	6.49	.196	3.56	74	1.06	10.0	1.18	48.1	28.7
MZ-1326	2.66	48	928.	.479	.288	7.65	.116	3.39	77	1.53	10.9	1.17	60.1	34.2
MZ-1328	2.40	58	765.	.475	.265	7.14	.128	3.43	70	1.72	8.8	1.03	59.6	34.2
MZ-1330	2.59	41	1060.	.383	.322	6.21	.118	5.18	74	1.68	8.2	1.10	63.1	30.2
MZ-1332	2.91	113	976.	.398	.365	7.04	.144	7.11	95	1.80	11.2	1.31	67.4	26.3
MZ-1334	3.58	< 109	765.	.620	.427	10.04	.173	4.80	87	1.30	14.9	1.51	70.9	45.0

Table A-3d. **Elemental analysis**, core hole 15/16 (continued).

SAMPLE ID	SM	SN	SR	TA	TB	TH	TI	U	V	W	Y	YB	ZN	ZR
ANAL.METH.	NAA PPM	NAA PPM	XRF PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM	NAA PPM	XRF PPM	NAA PPM	XRF PPM	XRF PPM
APPROX ERR	.01	50	.04*R	.004	.020	.05	.020	.03	15	.30	.6	.03	.04*R	2.0
MZ-1336	2.69	41	1250.	.374	.335	8.10	.153	3.90	80	1.63	11.9	1.34	95.0	42.5
MZ-1338	2.60	91	1140.	.400	.303	4.68	.142	2.41	67	1.07	11.2	1.18	61.3	39.6
MZ-1340	3.09	62	1020.	.419	.401	6.89	.108	3.57	67	.72	14.8	1.44	63.4	43.3
MZ-1342	3.46	< 123	888.	.486	.395	5.67	.182	2.90	77	1.23	14.7	1.39	70.5	49.6
MZ-1344	4.10	70	516.	.613	.530	8.43	.170	6.02	128	1.68	18.5	1.87	97.0	72.3
MZ-1346	4.52	87	386.	.645	.560	10.22	.208	5.66	150	2.12	19.4	1.94	97.6	58.6
BC-1372	4.97	< 156	429.	.746	.594	10.17	.246	6.23	137	1.10	22.8	2.24	102.0	69.0
ROS-1377	3.46	105	345.	.742	.511	3.81	.273	3.01	100	1.07	19.0	1.73	108.0	72.3
ROS-1382	2.91	47	902.	.442	.319	6.60	.090	3.28	77	1.06	11.4	1.35	63.6	32.5
ROS-1387	2.34	65	1000.	.366	.275	4.98	.115	4.67	85	1.66	7.5	.96	55.3	33.1
ROS-1392	3.31	70	749.	.549	.367	6.93	.176	4.62	97	.60	13.3	1.32	67.2	65.0
ROS-1397	2.53	44	953.	.408	.295	5.42	.145	3.70	102	1.41	9.3	1.06	64.7	38.0
ROS-1402	3.11	< 116	820.	.519	.378	7.06	.141	4.40	119	1.05	11.5	1.27	73.9	43.9
ROS-1407	2.49	< 97	1050.	.399	.289	5.68	.080	3.91	76	1.04	9.9	1.10	59.3	29.3
ROS-1412	2.66	< 104	1020.	.406	.315	6.30	.149	4.92	117	1.35	10.7	1.16	68.6	37.2
ROS-1417	2.95	< 125	807.	.460	.342	7.28	.253	5.10	64	2.05	11.2	1.28	74.6	42.2
ROS-1422	3.00	55	1030.	.454	.351	7.71	.162	4.25	88	1.44	11.7	1.31	75.2	40.0
ROS-1426	3.07	56	1060.	.440	.376	6.82	.158	4.26	79	.81	12.8	1.29	71.4	39.8
ROS-1445	2.85	70	660.	.474	.358	6.01	.140	4.64	118	.73	9.0	1.25	138.0	46.7
ROS-1450	2.60	< 119	863.	.400	.272	5.27	.156	4.43	111	1.50	10.0	1.12	89.3	41.3
ROS-1455	3.46	68	566.	.529	.403	6.15	.198	4.13	104	1.23	14.0	1.43	86.8	59.6
ROS-1460	3.00	< 129	602.	.466	.340	5.72	.176	4.61	116	.81	11.0	1.29	92.6	53.8
ROS-1465	3.12	< 110	491.	.522	.394	6.35	.186	4.61	130	1.07	13.0	1.42	89.2	60.6
ROS-1468	5.04	70	312.	.720	.566	9.93	.277	7.34	162	.86	20.8	2.17	116.0	72.9
POS-1518	4.01	57	468.	.602	.468	7.94	.229	4.44	125	1.66	17.2	1.81	98.0	76.1
POS-1568	4.78	129	382.	.736	.656	9.29	.264	4.65	156	1.74	20.5	2.06	105.0	90.9
POS-1618	3.95	83	470.	.616	.506	7.64	.186	3.77	140	1.25	17.1	1.70	87.5	80.2
POS-1668	4.55	< 129	394.	.707	.566	9.18	.247	3.52	124	1.22	20.3	1.97	91.2	103.0
POS-1718	4.21	72	449.	.653	.527	7.82	.208	3.38	168	1.73	18.9	1.80	94.7	86.5
POS-1768	3.78	61	488.	.578	.505	7.42	.197	3.59	156	1.03	16.2	1.63	87.7	79.0
POS-1818	3.83	52	459.	.621	.512	7.53	.226	3.64	120	1.49	15.9	1.78	84.8	94.8
POS-1868	3.63	74	466.	.563	.484	7.60	.208	4.11	115	1.46	15.8	1.67	86.6	81.0
POS-1918	4.40	< 137	384.	.698	.608	9.07	.255	3.44	131	1.65	20.2	2.11	117.0	118.0
POS-1968	3.91	70	411.	.602	.529	8.06	.246	4.34	147	1.48	17.9	1.90	89.1	94.4
POS-2019	3.38	80	505.	.502	.435	6.61	.164	3.27	97	1.25	15.4	1.53	82.1	75.7

Table A-4. Oil shale assays by modified Fischer Retort Method, core hole 25.

SAMPLE ID	OIL PERC	WATER PERC	SPENT SHALE PERC	GAS + LOSS PERC	OIL GAL/T	WATER GAL/T	SPEC.GRAV. OF OIL AT 60 DEG. F	SPENT SHALE TENDENCY TO COKE
SCZ- 180	0.85	2.55	96.10	0.50	2.20	6.10		NONE
SCZ -230	2.75	2.10	94.25	0.90	6.85	5.35	.945	NONE
SCZ- 280	2.90	1.45	94.70	0.95	7.30	3.45	.944	NONE
SCZ- 330	2.40	0.95	95.55	1.10	6.20	2.30	.931	NONE
SCZ- 388	3.55	1.15	94.30	1.00	9.10	2.75	.938	NONE
CCS- 393	5.65	1.50	91.65	1.20	14.45	3.60	.937	NONE
CCS- 398	6.45	1.50	90.30	1.75	16.50	3.60	.935	NONE
CCS- 403	4.20	0.90	93.75	1.15	10.80	2.20	.937	NONE
CCS- 408	5.80	1.35	91.45	1.40	14.95	3.25	.936	NONE
CCS- 413	5.85	1.55	91.25	1.35	15.00	3.70	.939	NONE
CCS- 418	5.50	1.15	91.15	1.20	14.15	2.75	.936	NONE
CCS- 423	5.75	1.35	91.65	1.25	14.80	3.25	.936	NONE
CCS- 428	5.35	1.45	91.60	1.60	13.90	3.50	.918	NONE
CCS- 433	5.60	1.45	91.55	1.90	14.50	3.45	.926	NONE
CCS- 438	8.00	1.55	88.45	2.00	20.90	3.70	.921	NONE
CCS- 443	9.55	1.60	86.55	2.30	24.95	3.80	.917	NONE
CCS- 448	5.15	1.50	91.95	1.40	13.55	3.60	.920	NONE
CCS- 453	4.25	1.95	92.50	1.30	11.15	4.70	.920	NONE
CCS- 458	5.65	2.10	90.65	1.60	14.70	5.00	.923	NONE
CCS- 463	4.25	1.45	92.55	1.35	11.15	4.45	.925	NONE
CCS- 468	2.80	1.85	94.30	1.05	7.30	4.45	.921	NONE
CCS- 473	6.00	1.95	90.25	1.80	15.55	4.65	.923	NONE
CCS- 478	4.25	2.30	91.95	1.50	10.95	5.50	.928	NONE
CCS- 483	4.95	2.15	91.25	1.65	12.75	5.15	.933	NONE
CCS- 488	5.40	1.95	90.95	1.70	13.85	4.70	.935	NONE
CCS- 493	4.35	1.35	92.75	1.55	11.35	3.25	.924	NONE
CCS- 498	8.60	1.85	86.95	2.60	22.35	4.45	.926	NONE
CCS- 503	3.30	1.25	94.35	1.10	8.60	3.00	.930	NONE
CCS- 508	4.95	1.70	91.80	1.55	12.70	4.10	.931	NONE
CCS- 513	8.15	2.40	87.45	2.00	21.10	5.80	.926	NONE
CCS- 518	4.25	1.20	93.25	1.30	11.05	2.30	.922	NONE
CCS- 523	9.95	1.75	85.65	2.65	25.60	4.20	.928	NONE
CCS- 528	6.00	1.05	91.50	1.45	15.55	2.55	.928	NONE
CCS- 533	4.55	0.75	93.05	1.65	11.75	1.80	.929	NONE
CCS- 538	5.85	2.15	90.70	1.30	14.95	5.15	.938	NONE
CCS- 543	5.00	1.55	92.25	1.20	12.80	3.70	.940	NONE
CCS- 548	4.60	1.50	92.55	1.35	11.75	3.60	.937	NONE
CCS- 553	4.85	1.45	92.25	1.45	12.40	3.45	.937	NONE
CCS- 558	5.25	1.65	91.80	1.30	13.50	3.95	.934	NONE
CCS- 563	4.25	1.25	93.55	1.15	10.50	3.00	.933	NONE
CCS- 568	6.85	1.35	90.15	1.65	17.75	3.25	.930	NONE
CCS- 573	5.20	1.40	92.05	1.35	13.35	3.40	.930	NONE
CCS- 578	3.80	2.35	92.80	1.05	9.75	5.65	.939	NONE
CCS- 583	4.80	1.50	92.35	1.35	12.30	3.60	.935	NONE
CCS- 588	7.20	1.25	90.25	1.30	18.55	3.00	.927	NONE
CCS- 593	6.00	1.70	90.80	1.50	15.45	4.10	.933	NONE
CCS- 598	4.70	1.70	92.45	1.15	11.95	4.05	.934	NONE
CCS- 603	3.35	1.00	94.90	0.75	8.80	2.40	.926	NONE

Table A-4. Oil shale assays by modified Fischer Retort Method, core hole 25 (continued).

SAMPLE ID	OIL PERC	WATER PERC	SPENT SHALE PERC	GAS + LOSS PERC	OIL GAL/T	WATER GAL/T	SPEC.GRAV. OF OIL AT 60 DEG. F	SPENT SHALE TENDENCY TO COKE
CCS- 608	6.55	1.55	90.45	1.45	17.00	3.70	.922	NONE
CCS- 613	7.95	1.35	88.85	1.85	20.70	3.25	.921	NONE
CCS- 618	4.60	1.00	93.20	1.20	11.95	2.40	.928	NONE
CCS- 623	6.85	1.25	90.05	1.85	17.75	3.00	.928	NONE
CCS- 628	4.60	1.15	92.80	1.45	11.80	2.75	.932	NONE
CCS- 634	2.45	1.10	95.80	0.65	6.20	2.60	.933	NONE
MZ- 636	1.80	0.65	96.85	0.70	4.65	1.55		NONE
MZ- 638	0.75	0.90	97.70	0.65	1.95	2.20		NONE
MZ- 640	0.85	1.05	97.60	0.50	2.15	2.50		NONE
MZ- 642	4.45	1.65	92.45	1.45	11.65	3.95	.913	NONE
MZ- 644	4.90	1.55	92.25	1.30	12.85	3.70	.909	NONE
MZ- 646	11.20	2.00	84.60	2.20	29.45	4.80	.913	NONE
MZ- 648	6.05	1.65	90.75	1.55	15.80	3.95	.911	NONE
MZ- 650	6.85	2.95	88.55	1.65	17.85	7.10	.923	NONE
MZ- 652	9.45	2.05	86.50	2.00	24.55	4.90	.923	NONE
MZ- 654	12.30	2.45	82.70	2.55	32.25	5.90	.912	NONE
MZ- 656	8.85	1.90	87.15	2.10	23.35	4.60	.906	NONE
MZ- 658	7.05	2.00	89.30	1.65	18.30	4.80	.920	NONE
MZ- 660	8.20	1.65	88.20	1.95	21.35	3.95	.919	NONE
MZ- 662	6.05	1.55	90.35	2.05	15.70	3.70	.923	NONE
MZ- 664	4.45	1.65	92.65	1.25	11.60	3.95	.923	NONE
MZ- 666	3.40	0.70	94.70	1.20	8.85	1.65	.915	NONE
MZ- 668	4.15	0.90	94.00	0.95	10.85	2.20	.914	NONE
MZ- 670	13.10	2.15	81.45	2.80	34.10	5.15	.920	NONE
MB- 671	8.75	1.90	87.20	2.15	22.95	4.60	.910	NONE
MB- 672	8.25	1.35	88.35	2.05	21.65	3.25	.911	NONE
MB- 673	9.45	1.10	86.90	2.55	24.80	2.65	.913	NONE
MB- 674	13.20	1.80	82.30	2.70	34.60	4.30	.917	NONE
MB- 675	13.65	1.80	80.85	3.70	35.55	4.35	.923	NONE
MB- 676	18.70	1.60	75.60	4.10	49.70	3.80	.903	MODERATE
MB- 677	21.30	2.25	71.50	4.95	56.50	5.40	.904	MODERATE
MB- 678	23.85	2.30	68.60	5.25	62.90	5.50	.908	HEAVY
MB- 679	18.50	1.90	75.35	4.25	49.05	4.55	.904	SLIGHT
MB- 680	18.15	1.60	76.50	3.75	47.65	3.80	.911	SLIGHT
MB- 681	12.25	1.20	84.00	2.55	32.45	2.85	.905	SLIGHT
MB- 682	18.85	2.05	74.85	4.25	49.80	4.90	.909	SLIGHT
MB- 683	14.10	1.35	81.40	3.15	36.55	3.25	.924	NONE
MB- 684	9.40	1.20	87.10	2.30	24.30	2.90	.926	NONE
MB- 685	7.80	1.10	88.90	2.20	20.40	2.65	.917	NONE
MB- 686	12.30	1.10	83.90	2.70	32.20	2.60	.914	NONE
MB- 687	16.65	1.40	78.75	3.20	43.35	3.40	.920	SLIGHT
MB- 688	12.20	1.40	83.50	2.90	31.45	3.40	.928	NONE
MB- 689	7.10	0.95	89.85	2.10	18.50	2.30	.921	NONE
MB- 690	12.75	1.25	83.55	2.45	33.70	3.00	.908	NONE
MZ- 692	14.10	1.40	81.55	2.95	37.30	3.40	.906	NONE
MZ- 694	13.60	1.40	81.85	3.15	35.95	3.35	.907	NONE
MZ- 696	6.50	1.05	90.95	1.50	17.35	2.50	.891	NONE
MZ- 698	8.40	1.45	88.15	2.00	22.15	3.50	.907	NONE

Table A-4. Oil shale assays by modified Fischer Retort Method, core hole 25 (continued).

SAMPLE ID	OIL PERC	WATER PERC	SPENT SHALE PERC	GAS + LOSS PERC	OIL GAL/T	WATER GAL/T	SPEC.GRAV. OF OIL AT 60 DEG. F	SPENT SHALE TENDENCY TO COKE
MZ- 700	5.55	1.35	91.50	1.60	14.40	3.25	.919	NONE
MZ- 702	9.70	1.45	86.60	2.25	25.70	3.45	.905	NONE
MZ- 705	12.90	1.65	82.65	2.80	34.35	3.95	.903	NONE
FCS- 750	2.50	1.55	95.10	0.85	6.50	3.70	.918	NONE
FCS- 790	0.30	2.00	97.05	0.65	0.70	4.80		NONE

Table A-5. X-ray diffraction results, core hole 25.

SAMPLE ID	ANALCIME	QUARTZ	CALCITE	DOLOMITE	NA FELDSPAR	K FELDSPAR	MAGN.SID.	PYRITE	ILLITE	ARAGONITE	DAWSONITE	FLUORITE
	(........ESTIMATED PERCENT........)				(................................PEAK HEIGHT................................)							
SCZ- 180	12	13	1	21	98	37	4	5	3			
SCZ -230	9	11	4	33	18	21	4	6	3			
SCZ- 280	6	9	6	32	38	29	6					
SCZ- 330	2	8	7	35	67	29	3					
SCZ- 388	3	9	6	31	36	24	3		2			
CCS- 393	5	9	5	32	22	21	5		3			
CCS- 398	4	8	4	30	29	18	3		4			
CCS- 403	3	8	6	30	23	31	5	4	3			
CCS- 408	5	7	12	27	28	15			2			
CCS- 413	6	9	11	30	22	13			3			
CCS- 418	4	8	16	29	12	12						
CCS- 423	4	9	12	33	21	12						
CCS- 428	5	9	7	31	28	23			3			
CCS- 433	6	10	6	34	25	21			3			
CCS- 438	5	9	7	30	39	17			3			
CCS- 443	3	9	7	25	32	24	5		4			
CCS- 448	5	9	5	28	25	26	3		2			
CCS- 453	6	9	6	29	27	17	3		4			
CCS- 458	7	9	4	29	28	18	3		3			
CCS- 463	6	10	4	36	25	16			3			
CCS- 468	5	10	1	32	25	25	3		4			
CCS- 473	7	10	3	31	27	23	4		4			
CCS- 478	7	10	3	32	21	15	3		4			
CCS- 483	7	10	8	29	23	16	3		5			
CCS- 488	6	11	5	37	19	17	3		5			
CCS- 493	4	9	3	31	22	36	6		4			
CCS- 498	5	9	10	28	19	15	6		4			
CCS- 503	3	9	6	34	16	27	4		3			
CCS- 508	9	10	8	33	15	19	4		4			
CCS- 513	12	10	6	30	20	15			4			
CCS- 518	3	10	7	33	13	24			4			
CCS- 523	5	10	3	33	18	24	5		4			
CCS- 528	3	11	4	35	14	32	5		4			
CCS- 533		11	3	37	13	40	7		3			
CCS- 538	13	12	7	31	15	18	4		5			
CCS- 543	6	13	10	42	14	12			3			
CCS- 548	6	10	10	34	13	12	4		3			
CCS- 553	8	10	10	33	12	9			3			
CCS- 558	6	10	7	31	8	10	4		3			
CCS- 563	3	10	7	32	10	20			2			
CCS- 568	5	9	10	32	10	13	3		3			
CCS- 573	6	11	12	35	11	12			2			
CCS- 578	12	15	8	30	19	15			3			
CCS- 583	7	10	13	28	11	12	3					
CCS- 588	5	9	15	27	10	12						
CCS- 593	9	9	9	33	16	10			4			
CCS- 598	6	9	8	35	11	11			3			
CCS- 603	2	11	3	36	9	25	4					

Table A-5. X-ray diffraction results, core hole 25 (continued).

SAMPLE ID	ANALCIME	QUARTZ	CALCITE	DOLOMITE	NA FELDSPAR	K FELDSPAR	MAGN.SID.	PYRITE	ILLITE	ARAGONITE	DAWSONITE	FLUORITE
	(........ESTIMATED	PERCENT	....	........)	(........	....	....	PEAK HEIGHT	....	....	....	....
COS- 608	6	8	9	33	19	13			3			
CCS- 613	4	9	6	30	16	19						
OCS- 618	3	8	5	35	14	24	4		3			
CCS- 623	4	8	6	31	16	23	4		3			
CCS- 628	6	8	8	32	16	17	3		3			
OOS- 634	5	11	1	42	10	23	3					
MZ- 636		9		35	14	23	7		3			
MZ- 638		9		25	16	56	11		4			
MZ- 640		9		24	16	59	16		5			
MZ- 642	4	10		32	15	36	9		5			
MZ- 644	2	8		31	12	35	6		5			
MZ- 646	6	7	1	30	18	19	7					
MZ- 649	3	9		32	15	22	4					
MZ- 650	14	12		29	42	34	8					
MZ- 652	8	10	6	31	28	14			4			
MZ- 654	11	12	2	28	33	18			6			
MZ- 656	11	12	5	34	19	18	6		4			
MZ- 658	8	10	2	33	16	17			4	22		
MZ- 660	7	9	4	32	11	17			5	18		
MZ- 662	8	11	3	42	9	17			4			
MZ- 664	9	13		33	16	32	6		2			
MZ- 666		14		32	15	47	9		3			
MZ- 668	4	11	3	36	14	35	5		4			
MZ- 670	7	9	2	30	14	13			6			
MB- 671	9	9	5	35	27	10			4			
MB- 672	5	9	5	39	25	14						
MB- 673	4	14	3	43	29	15			4			
MB- 674	6	13	1	39	51	12			4			
MB- 675	8	12	3	35	72	11		8	4			
MB- 676	2	10	5	37	75	20						
MB- 677		9		28	102	23	8	9	6			
MB- 678		8		25	87	17	7	16				
MB- 679		9		26	70	44	6	10	6			
MB- 680	1	9	1	27	98	33	8	7				
MB- 681	3	9	6	35	92	22	5	7				
MB- 682		11	1	32	106	27	2	8	5			
MB- 683	9	9	7	28	91	16	4	9				
MB- 684	2	8	11	28	73	15	3	8	3			
MB- 685	3	9	7	31	64	15						
MB- 686	1	8	6	33	72	17			3			
MB- 687	3	13	1	30	74	21		8	5			
MB- 688	3	7	12	21	78	13			4			
MB- 689		7	15	31	55	12						
MB- 690	2	10	8	29	75	21	5	5	4			
MZ- 692	3	10	4	28	102	24	4	4	4			
MZ- 694	4	16	2	29	82	36	5	5	5			
MZ- 696	3	8	6	28	47	32	4	6				
MZ- 698	4	9	7	41	57	17			3			

Table A-5. X-ray diffraction results, core hole 25 (continued)

X-RAY DIFFRACTION RESULTS

SAMPLE ID	ANALCIME	QUARTZ	CALCITE	DOLOMITE	NA FELDSPAR	K FELDSPAR	MAGN.SID.	PYRITE	ILLITE	ARAGONITE	DAWSONITE	FLUORITE
	(........ESTIMATED PERCENT........)				(..PEAK HEIGHT..)							
MZ- 700	7	12	6	39	36	17	2		4			
MZ- 702	9	10	3	67	25	19			4			
MZ- 705	11	9	5	37	16	18			4			
RCS- 750	9	9	3	34	22	25	4		3			
RCS- 790	11	11	3	24	28	17	6		2			

Table A-6a. Elemental analysis, core hole 25.

SAMPLE ID	AG	AL	AS	AU	B	BA	BR	C(MIN)	C(ORG)	CA	CD	CE	CL	CO	CR
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	OES PPM	NAA PPM	XRF PPM	GRAV PERC	COMB PERC	NAA PERC	IZAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM
APPROX ERR	.5	.10	1.5	.015	.2*R	15	.35	.02		.6	.04	.7	.030	.20	2.3
SCZ- 180	.9	6.17	17.9	<.046	60.	907	.41	2.22	1.69	3.9	.53	66.5	<.116	12.27	70.6
SCZ -210	.8	4.61	24.0	<.046	60.	703	<1.00	4.72	4.04	10.6	.59	49.2	<.079	9.07	42.1
SCZ- 280	< 1.5	4.31	27.1	<.045	40.	464	< .86	5.12	4.38	13.2	.55	45.0	<.072	7.91	41.6
SCZ- 330	.7	4.19	31.9	.021	40.	468	.57	5.42	3.66	12.9	.62	42.4	<.075	8.30	47.9
SCZ- 388	< 1.4	3.49	29.9	<.041	80.	539	< .69	5.38	5.07	11.5	.42	42.5	<.060	8.30	38.1
CCS- 393	< 1.6	3.76	36.6	<.042	80.	531	.36	5.36	7.30	11.7	.39	42.4	.088	8.77	37.1
CCS- 398	.6	3.91	44.5	.024	80.	727	< .82	5.08	8.48	11.8	.68	39.9	.048	9.15	44.1
CCS- 403	< 1.4	4.28	28.2	.015	80.	549	< .70	5.22	5.63	12.2	.62	44.3	.039	9.46	40.0
CCS- 408	.6	3.37	40.3	<.041	60.	496	< .89	5.87	7.38	14.6	.57	35.8	.034	8.31	32.7
CCS- 413	.9	3.49	38.1	<.035	60.	505	< .70	5.85	7.39	15.7	.61	35.3	<.079	7.62	34.6
CCS- 418	.6	2.08	32.0	<.024	50.	526	< .95	7.20	6.68	18.6	.29	25.0	<.074	6.16	17.1
CCS- 423	< 1.3	2.45	39.9	.018	50.	536	< .71	6.67	7.27	16.3	.36	29.1	.039	7.16	27.0
CCS- 428	.7	3.75	37.0	<.029	80.	501	.45	5.32	6.83	11.4	.38	38.7	.041	9.23	35.7
CCS- 433	.6	3.09	43.0	<.040	80.	469	< .79	5.86	7.33	13.7	.22	32.0	<.058	7.84	27.3
CCS- 438	1.0	3.58	29.5	<.026	80.	522	< .72	5.02	10.24	13.0	.26	37.2	<.079	9.24	27.7
CCS- 443	< 1.2	3.52	37.9	.016	80.	440	< .87	4.82	12.15	12.2	.34	34.9	.040	9.49	29.7
CCS- 448	.5	4.11	29.2	.016	100.	486	< .74	4.62	7.17	10.5	.27	42.9	<.084	9.98	37.7
CCS- 453	1.2	4.08	22.3	.016	100.	522	.41	4.95	5.75	11.3	.29	44.3	<.076	9.74	30.5
CCS- 458	.6	4.05	39.8	<.032	100.	458	< .78	5.35	7.03	9.8	.38	38.5	<.064	9.64	41.0
CCS- 463	< 1.0	3.90	24.7	<.023	100.	432	< .94	5.42	5.58	11.7	.34	38.6	<.069	7.85	37.2
CCS- 468	1.0	4.63	22.8	.018	100.	491	< .68	4.40	3.80	8.0	.35	47.0	<.072	9.40	53.9
CCS- 473	< 1.1	3.97	36.8	.026	100.	501	< .73	4.72	7.62	10.9	.40	41.3	<.073	9.18	35.9
CCS- 478	.8	4.16	28.4	.141	100.	503	< .72	4.96	5.50	10.4	.42	45.4	.091	8.79	46.5
CCS- 483	.8	3.47	31.4	<.037	100.	515	.53	5.38	6.51	12.2	.39	40.3	<.071	7.32	36.0
CCS- 488	.6	3.38	36.7	<.025	100.	511	.40	5.51	7.13	12.7	.50	40.2	.039	7.63	31.3
CCS- 493	.7	4.81	47.5	<.035	100.	524	< .84	4.24	5.61	8.6	.88	51.5	<.068	10.54	45.7
CCS- 498	.5	3.00	42.4	.016	100.	559	< .81	5.44	10.80	14.0	.67	39.6	<.066	7.56	31.6
CCS- 503	.7	3.83	30.3	<.035	100.	551	< .93	5.48	4.40	11.5	.67	42.6	.043	8.10	31.1
CCS- 508	< 1.0	3.79	34.2	<.041	100.	571	< .68	5.44	5.88	12.4	.65	43.0	<.058	7.33	36.1
CCS- 513	.6	3.53	40.9	<.032	100.	548	< .64	4.89	9.89	10.7	.77	42.1	<.072	8.73	28.8
CCS- 518	.9	3.70	28.1	.012	120.	531	.45	5.56	5.44	12.4	.65	41.2	<.088	7.63	29.6
CCS- 523	< 1.4	3.71	53.4	<.032	100.	500	< .60	4.36	12.86	9.5	.72	40.7	<.086	9.15	35.4
CCS- 528	.8	3.96	34.3	<.024	120.	576	< .66	4.87	6.97	10.4	.77	48.4	<.072	7.42	27.6
CCS- 533	.9	4.34	30.1	<.028	150.	566	< .67	4.92	5.38	10.7	.65	46.9	.039	7.46	33.8
CCS- 538	1.3	4.03	41.9	<.034	80.	546	< .67	4.81	6.61	12.0	.81	45.3	.063	6.91	25.2
CCS- 543	.8	2.78	24.3	<.035	60.	504	< .67	6.30	6.00	15.1	.43	30.0	<.070	4.65	19.5
CCS- 548	< 1.2	2.89	26.0	<.029	60.	527	< .78	6.25	5.58	15.0	.41	35.3	<.089	5.41	24.1
CCS- 553	.5	3.10	27.4	<.029	80.	523	< .68	6.09	5.93	15.8	.56	35.0	.047	5.72	32.6
CCS- 558	.3	2.68	20.2	.019	80.	518	< .67	6.28	6.42	15.6	.49	34.9	<.059	5.87	22.9
CCS- 563	< 1.3	3.65	27.4	.043	80.	509	< .68	5.81	4.25	13.6	.59	41.1	.058	6.56	31.6
CCS- 568	< 1.4	2.73	37.2	<.037	60.	526	< .68	6.22	8.22	14.5	.29	30.8	.084	5.94	29.7
CCS- 573	.8	2.68	23.2	<.028	60.	551	< .88	6.42	6.29	15.0	.23	31.3	<.078	5.51	21.7
CCS- 578	.5	4.01	28.3	.026	60.	469	< .92	4.72	4.60	11.8	.25	43.8	<.070	4.75	17.0
CCS- 583	< 1.0	2.91	27.7	<.032	60.	536	< .69	6.44	5.91	15.5	.27	31.8	<.054	5.20	21.6
CCS- 588	.5	2.54	42.5	.016	60.	555	< .73	6.54	8.62	17.0	.28	27.6	<.059	6.29	25.6
CCS- 593	< 1.4	3.16	30.6	.094	70.	531	< .68	5.83	7.54	13.1	.30	34.1	.050	7.57	31.5
CCS- 598	< 1.3	3.09	28.0	<.036	80.	500	< .69	6.47	5.89	14.8	.26	35.4	<.083	6.65	27.5
CCS- 603	1.1	3.56	31.1	.053	120.	479	< .67	5.68	4.49	10.9	.28	38.2	<.062	7.47	33.9

Table A-6a. Elemental analysis, core hole 25 (continued)

SAMPLE ID	AG	AL	AS	AU	B	BA	BR	C(MIN)	C(ORG)	CA	CD	CE	CL	CO	CR
ANAL.METH.	NAA PPP	NAA PERC	NAA PPP	NAA PPP	OES PPP	NAA PPM	XRF PPM	GRAV PERC	COMB PERC	NAA PERC	IZAA PPP	NAA PPP	NAA PERC	NAA PPP	NAA PPP
APPROX ERR	.5	.10	1.5	.015	.2**	15	.35	.02		.6	.04	.7	.030	.20	3.0
CCS- 608	.6	2.64	16.5	.022	80.	507	< .67	6.47	7.94	15.3	.24	34.2	<.090	6.37	29.6
CCS- 613	< 1.2	3.04	48.4	<.047	80.	499	< .69	5.60		12.7	.32	34.5	.087	5.85	27.6
CCS- 618	< 1.3	3.93	33.2	.135	90.	510	< .87	5.88	6.34	12.6	.68	42.0	<.076	8.04	38.2
CCS- 623	1.0	3.65	63.0	.025	90.	508	< .71	5.40	8.67	11.8	.65	41.0	.081	9.89	34.3
CCS- 628	.5	3.35	62.3	.033	90.	520	< .86	6.15	5.96	13.0	.49	46.2	.032	7.67	35.6
CCS- 634	1.1	3.65	31.5	<.029	100.	433	< .89	6.27	3.08	11.2	.40	40.5	<.060	7.02	36.6
MZ- 636	< 1.9	5.03	40.6	.026	200.	372	< .76	4.50	2.74	7.5	.79	54.7	<.092	9.78	50.7
MZ- 638	1.4	6.52	17.1	.021	150.	389	< .79	3.04	1.68	4.9	.76	59.0	<.149	10.27	49.0
MZ- 640	1.1	6.49	15.8	<.041	150.	390	.40	2.93	1.87	4.8	.72	54.9	<.082	10.74	51.7
MZ- 642	< 1.5	5.04	27.4	<.039	150.	460	< .81	3.75	5.40	6.5	.90	50.2	<.071	10.41	51.0
MZ- 644	.6	4.73	17.9	<.028	150.	472	< .65	4.48	6.09	7.4	.56	48.0	<.056	7.62	38.9
MZ- 646	.5	3.16	31.9	.021	60.	612	< .65	4.95	13.21	11.6	.79	40.4	<.061	9.56	26.6
MZ- 648	< 1.0	3.54	26.5	<.028	100.	803	< .92	5.55	6.90	9.6	.54	42.4	.032	8.07	36.9
MZ- 650	.7	4.69	39.6	<.041	100.	538	< .65	3.48	8.05	5.7	.56	58.1	<.071	9.69	45.9
MZ- 652	.6	3.65	44.6	.025	70.	606	< .68	4.80	14.05	11.4	.88	42.5	<.080	10.15	33.7
MZ- 654	1.0	4.07	39.6	.018	80.	444	< .64	3.84	14.04	8.5	.99	63.1	<.054	11.82	33.4
MZ- 656	.6	3.61	36.5	.020	70.	520	< .67	4.57	11.25	11.1	.63	49.4	<.079	7.88	32.8
MZ- 658	< 1.1	4.09	34.5	.029	70.	535	< .67	5.05	8.94	11.4	.94	44.9	<.070	8.25	43.2
MZ- 660	.8	3.48	23.2	<.039	70.	560	< .67	4.54	11.84	13.8	.74	39.2	<.066	6.94	32.9
MZ- 662	< 1.2	3.86	27.6	.018	80.	528	< .85	5.44	7.26	11.0	.61	41.0	.041	7.07	41.3
MZ- 664	1.1	5.27	29.6	<.046	120.	468	< .69	3.67	5.78	6.6	.59	83.7	.081	7.57	40.9
MZ- 666	.9	5.45	30.4	<.037	200.	477	< .90	3.60	4.60	5.9	.79	56.5	<.059	10.12	49.7
MZ- 668	1.4	4.51	29.5	<.036	80.	510	< .68	4.97	5.04	10.2	.76	49.1	.089	9.21	40.5
MZ- 670	.6	3.27	40.2	.022	60.	470	< .70	4.56	15.63	10.1	.72	37.2	<.064	10.83	28.5
MB- 671	1.8	3.64	55.8	<.046	50.	502	< .83	5.03	10.46	10.9	.94	41.9	.046	8.22	29.7
MB- 672	.7	2.94	15.8	.021	50.	441	< .65	6.28	8.54	13.3	.50	29.4	<.071	5.37	22.1
MB- 673	< 1.6	2.31	16.7	.016	50.	444	< .62	5.55	11.19	11.2	.50	27.6	.048	5.89	22.0
MB- 674	1.1	3.25	63.8	.019	50.	400	< .76	4.36	15.56	8.4	.76	30.0	<.084	8.07	32.2
MB- 675	.7	3.62	97.5	.022	60.	406	< .72	3.65	17.04	8.5	1.04	42.9	.047	12.24	39.8
MB- 676	< 1.0	2.43	25.9	<.036	40.	358	< .60	4.58	20.02	10.1	.72	27.5	<.085	7.49	29.2
MB- 677	.9	3.34	46.6	.051	80.	337	< .59	2.93	24.78	6.1	.47	31.8	<.056	11.08	27.7
MB- 678	< 1.1	2.70	63.9	.019	100.	477	< .62	2.17	26.73	6.4	.70	30.1	<.090	11.12	32.8
MB- 679	.8	3.90	61.7	<.053	100.	307	< .60	2.07	23.28	9.1	.86	40.4	<.077	12.82	35.8
MB- 680	.5	3.93	62.5	<.054	80.	377	< .62	2.42	21.94	7.2	1.15	44.6	<.066	11.41	35.6
MB- 681	.5	3.26	41.3	<.036	50.	392	< .83	4.70	14.94	11.0	.59	35.8	<.071	7.85	33.8
MB- 682	1.3	3.34	56.2	<.047	100.	269	< .60	2.58	24.96	6.1	1.42	34.8	<.072	11.28	32.7
MB- 683	< 1.6	3.92	92.5	<.058	60.	422	< .67	4.06	18.11	9.4	1.04	42.4	.033	9.29	31.5
MB- 684	1.3	3.08	69.8	<.044	40.	447	< .82	5.37	12.13	13.1	.70	36.8	<.080	8.15	35.5
MB- 685	.7	3.22	37.1	.027	50.	465	< .89	5.55	10.18	13.1	.61	34.8	.040	7.49	30.3
MB- 686	.5	2.75	68.0	<.038	50.	422	< .67	5.30	15.39	10.6	.70	32.0	<.058	6.73	25.5
MB- 687	.5	3.42	82.9	<.047	60.	361	< .65	3.16	21.13	8.0	.65	39.3	<.056	11.16	39.0
MB- 688	.5	3.21	97.6	.026	50.	444	.82	4.82		12.9	1.10	40.0	<.061	10.79	32.3
MB- 689	< 1.0	2.03	8.2	.034	40.	551	< .86	7.07	9.18	17.2	.45	24.5	.033	4.38	17.6
MB- 690	.7	2.82	63.9	<.043	50.	405	< .67	4.85	15.12	11.3	.76	32.0	.035	8.06	31.3
MZ- 692	.5	3.69	78.6	<.067	50.	396	< .76	3.64	16.15	8.8	1.08	47.0	<.078	10.92	37.1
MZ- 694	< 1.1	4.27	71.2	<.044	50.	395	< .77	3.41	15.00	7.9	1.04	47.5	<.060	11.25	34.8
MZ- 696	1.1	4.36	28.1	<.041	60.	433	< .83	4.55	7.64	11.5	.92	48.7	.040	9.55	44.6
MZ- 698	< 1.2	2.92	26.7	<.034	50.	469	< .66	6.07	9.77	12.6	.58	32.5	<.092	6.22	25.7

Table A-6a. Elemental analysis, core hole 25 (continued).

SAMPLE ID	AG	AL	AS	AU	B	BA	BR	C(MIN)	C(ORG)	CA	CD	CE	CL	CO	CR
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPB	DES PPM	NAA PPM	XRF PPM	GRAV PERC	COMB PERC	NAA PERC	IZAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM
APPROX ERR	.5	.10	1.5	.015	.20	15	.35	.02		.6	.04	.7	.030	.20	3.0
PZ- 700	.7	2.88	16.2	<.030	50.	484	< .78	5.88	7.23	12.9	.54	32.3	.067	5.84	23.8
MZ- 702	1.1	2.77	25.6	<.039	50.	457	< .78	5.74	11.93	11.6	.77	31.9	<.073	7.68	31.9
PZ- 705	.6	2.70	30.5	.015	50.	448	< .84	5.26	15.58	11.4	.88	27.6	<.090	6.95	20.9
FCS- 750	.6	4.33	15.9	.024	100.	529	< .94	5.28	3.42	9.7	.70	50.2	<.052	6.97	34.2
FCS- 790	.7	6.10	9.5	<.065	100.	445	< .81	3.47	.86	7.8	.83	64.9	<.108	8.91	62.9

Table A-6b. Elemental analysis, core hole 25.

SAMPLE ID	CS	CU	DY	EU	F	FE	GA	GE	H	HG	HF	IN	IR	K	LA
ANAL.METH.	NAA PPM	XRF PPM	NAA PPM	NAA PPM	SP PERC	NAA PERC	XRF PPM	XRF PPM	COMB PERC	IZAA PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM
APPROX ERR	.15	1.5	.08	.010	.03*R	.03	.7	.60	.02	.1*R	.05	.10	.004	.20	.5
SCZ- 180	5.79	24.3	2.72	1.009	.110	3.04	14.7	<1.62	.47	.034	3.60	< .12	<.009	2.39	33.6
SCZ -230	5.93	29.9	2.51	.692	.102	2.57	11.1	.75	.72	.055	2.02	.13	<.007	2.35	23.0
SCZ- 260	5.35	31.5	2.73	.660	.069	2.32	9.8	1.34	.65	.056	1.97	< .14	<.008	2.13	27.2
SCZ- 330	3.23	32.7	2.42	.647	.066	2.31	9.8	.63	.64	.057	1.82	.13	.005	1.83	20.9
SCZ- 388	5.27	30.1	2.47	.628	.052	2.23	9.4	<1.19	.82	.054	1.77	.09	<.006	2.16	20.5
CCS- 393	6.05	33.2	2.45	.628	.091	2.11	8.9	<1.17	1.14	.063	1.72	< .12	<.008	1.73	20.0
CCS- 398	5.20	35.9	2.35	.596	.142	2.32	9.6	1.15	1.33	.065	1.64	< .11	<.007	2.12	19.8
CCS- 403	4.57	41.0	2.43	.654	.055	2.43	9.6	1.04	.91	.067	1.53	< .20	<.007	2.80	21.5
CCS- 408	5.33	37.1	1.90	.512	.070	1.99	8.1	<1.53	1.16	.079	1.53	< .18	<.006	1.44	16.9
CCS- 413	5.34	32.6	1.87	.518	.095	1.97	7.9	<1.61	1.14	.065	1.42	.13	<.006	1.39	17.7
CCS- 418	3.40	20.3	1.50	.390	.098	1.36	5.3	<1.23	1.02	.054	1.12	.05	.004	.84	12.7
CCS- 423	4.19	23.1	1.59	.415	.102	1.47	6.4	<1.21	1.16	.055	1.37	.07	.004	1.10	14.6
CCS- 428	5.12	28.6	1.83	.498	.119	2.35	9.4	1.42	1.16	.036	1.88	.08	<.006	2.01	19.3
CCS- 433	5.23	19.4	1.46	.440	.130	1.84	7.2	<1.73	1.19	.042	1.67	< .16	<.006	1.07	15.6
CCS- 438	5.25	27.5	2.09	.574	.113	1.89	7.4	<1.73	1.50	.037	1.81	.05	<.006	1.45	18.4
CCS- 443	4.54	30.6	1.96	.509	.083	2.08	8.4	.91	1.73	.035	1.94	< .14	<.006	1.78	18.1
CCS- 448	5.45	30.4	2.14	.604	.077	2.48	10.8	1.00	1.14	.036	1.98	< .26	<.009	2.04	21.4
CCS- 453	5.84	33.7	2.33	.605	.086	2.37	10.3	1.04	.98	.025	1.87	.16	<.006	1.69	21.2
CCS- 458	5.44	30.2	2.02	.529	.091	2.32	9.5	.83	1.18	.037	1.91	< .44	<.006	1.26	19.0
CCS- 463	4.79	21.5	1.86	.532	.087	2.12	8.2	<1.75	.97	.030	1.99	< .37	<.007	1.29	19.6
CCS- 468	5.81	30.3	2.42	.654	.111	2.79	11.8	1.01	.84	.032	2.12	< .10	<.010	2.92	23.8
CCS- 473	5.16	31.4	2.23	.603	.126	2.34	9.6	.95	1.24	.053	1.84	.09	<.006	1.80	20.6
CCS- 478	5.62	29.3	2.41	.671	.116	2.51	9.5	<1.60	1.03	.041	1.77	.09	<.008	1.82	22.0
CCS- 483	5.09	28.3	2.25	.602	.090	2.05	9.4	1.70	.90	.042	1.79	.23	<.006	1.70	19.3
CCS- 488	4.59	26.4	2.11	.576	.163	1.89	8.1	1.38	.96	.050	1.66	< .26	<.006	1.56	18.3
CCS- 493	5.73	38.3	2.81	.778	.151	2.84	12.0	<1.30	.88	.073	1.85	.09	<.007	3.18	26.2
CCS- 498	5.09	18.3	2.43	.599	.157	1.78	7.8	<1.31	1.36	.060	1.72	< .14	<.006	1.38	18.9
CCS- 503	4.69	32.5	2.28	.626	.129	2.24	8.9	.87	.66	.056	1.90	.10	<.006	2.65	22.0
CCS- 508	5.17	24.9	2.23	.638	.127	1.92	7.6	<1.16	.88	.050	1.97	< .16	<.006	1.54	21.5
CCS- 513	5.64	29.4	2.21	.597	.154	1.98	8.1	<1.12	1.36	.052	2.05	< .20	.006	1.10	20.0
CCS- 518	4.54	29.4	2.28	.611	.131	2.11	9.8	<1.17	.88	.056	1.71	.03	.007	2.42	19.9
CCS- 523	5.26	34.4	2.15	.560	.148	2.15	8.4	<1.10	1.77	.141	1.95	.08	<.009	2.01	20.0
CCS- 528	4.10	26.2	2.70	.643	.098	2.00	9.0	1.60	1.16	.055	2.19	< .24	<.006	2.83	21.8
CCS- 533	7.89	30.2	2.55	.669	.099	2.30	10.8	<1.17	.92	.054	2.02	.10	<.006	3.92	24.8
CCS- 538	5.72	25.3	2.27	.611	.149	1.92	8.5	<1.13	1.18	.065	2.29	.14	.006	1.58	21.8
CCS- 543	3.89	14.1	1.76	.431	.155	1.38	7.5	<1.21	.90	.025	1.50	< .26	<.005	1.26	14.7
CCS- 548	4.26	17.9	2.16	.499	.155	1.53	6.8	<1.18	.92	.026	1.56	< .20	.003	1.42	17.9
CCS- 553	4.45	20.5	2.10	.506	.198	1.59	6.7	<1.17	1.00	.036	1.75	.24	<.005	1.36	17.2
CCS- 558	4.35	18.7	1.92	.500	.218	1.51	8.0	<1.44	1.02	.046	1.98	< .32	<.009	1.64	18.8
CCS- 563	4.64	23.6	2.36	.603	.176	1.94	7.2	<1.46	.89	.037	1.86	< .31	<.006	2.37	19.7
CCS- 568	3.86	22.2	1.77	.462	.125	1.43	5.7	<1.16	1.22	.050	1.28	< .10	<.008	1.55	15.4
CCS- 573	3.53	20.1	1.78	.443	.098	1.42	5.2	<1.18	.94	.032	1.32	< .10	.005	1.17	15.8
CCS- 578	4.50	14.3	2.04	.506	.074	1.37	8.0	<1.34	.91	.041	2.41	.06	<.007	1.34	21.9
CCS- 583	3.74	16.4	1.78	.448	.154	1.36	5.3	<1.55	.93	.053	1.37	< .14	.003	1.05	15.4
CCS- 588	3.71	24.2	1.65	.437	.113	1.44	6.3	<1.18	1.26	.072	1.17	< .13	<.009	1.02	14.2
CCS- 593	5.74	29.7	2.13	.575	.204	1.83	7.3	<1.18	1.18	.075	1.41	< .13	<.008	1.22	18.3
CCS- 598	5.16	22.1	2.03	.529	.162	1.70	7.3	<1.63	.94	.051	1.47	.06	<.008	1.18	16.2
CCS- 603	3.80	28.7	2.12	.577	.158	2.03	8.7	.69	.84	.059	1.39	< .12	<.006	3.18	19.2

Table A-6b. Elemental analysis, core hole 25 (continued).

SAMPLE ID	CS	CU	DY	EU	F	FE	GA	GE	H	HG	HF	IN	IR	K	LA
ANAL.METH.	NAA PPM	XRF PPM	NAA PPM	NAA PPM	SP PERC	NAA PERC	XRF PPM	XRF PPM	COMB PERC	IZAA PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM
APPROX ERR	.15	1.5	.08	.010	.03*D	.03	.7	.60	.02	.1*R	.05	.10	.004	.20	.5
CCS- 608	4.67	19.6	1.81	.516	.169	1.45	8.0	.99	1.13	.044	1.42	< .14	<.005	1.15	16.3
CCS- 613	4.21	29.1	1.84	.527	.155	1.68	7.1	<1.37	1.47	.088	1.54	< .15	<.007	1.61	16.5
CCS- 618	3.92	30.8	2.29	.636	.094	1.49	9.5	<1.42	.45	.079	1.95	.05	<.007	2.66	20.3
CCS- 623	4.95	34.1	2.29	.649	.113	2.08	7.9	.89	1.28	.087	1.49	.12	<.006	2.09	20.3
CCS- 628	4.03	24.0	2.04	.599	.124	1.69	7.5	<1.51	.57	.070	1.46	.10	<.006	1.97	19.5
CCS- 634	4.63	22.5	2.34	.636	.060	1.97	8.5	<1.10	.89	.047	1.90	< .17	<.006	2.37	19.7
PZ- 636	4.13	31.1	2.76	.777	.114	2.70	13.0	<1.45	.54	.056	2.37	< .15	<.007	4.82	27.1
PZ- 638	4.70	34.1	3.67	.970	.112	3.17	15.6	.76	.42	.071	2.45	.07	<.007	5.66	32.8
PZ- 640	4.59	33.6	3.25	.863	.127	3.22	15.6	<1.74	.46	.068	2.34	.10	<.007	5.58	29.9
PZ- 642	5.07	31.6	2.33	.639	.234	2.55	11.7	.77	1.08	.051	2.54	< .17	<.007	4.26	25.8
PZ- 644	5.58	26.0	2.58	.666	.228	2.28	11.5	<1.31	1.05	.031	2.26	.09	<.007	3.79	23.1
PZ- 646	4.29	34.4	2.15	.584	.181	1.74	7.8	<1.11	1.98	.039	1.62	.07	.004	1.29	19.6
PZ- 648	3.76	31.3	2.12	.636	.188	1.96	8.3	<1.42	1.15	.038	1.68	.11	<.006	1.64	20.5
PZ- 650	5.39	30.2	2.26	.821	.223	2.11	11.6	<1.10	1.39	.074	2.70	.12	<.006	1.30	30.7
PZ- 652	4.72	33.4	2.16	.667	.122	2.06	8.6	.93	1.78	.072	2.21	< .15	<.006	1.29	21.3
PZ- 654	5.43	46.2	2.21	.625	.179	2.42	9.7	1.04	2.18	.096	2.19	< .16	<.006	1.43	21.1
PZ- 656	4.89	27.0	2.51	.896	.134	1.87	8.8	.83	1.72	.045	2.20	< .15	<.006	1.48	21.5
PZ- 658	5.03	33.5	2.72	.899	.130	2.27	9.1	<1.16	1.31	.065	1.82	< .17	<.006	1.18	21.7
PZ- 660	4.81	25.9	2.60	.613	.141	1.83	8.2	<1.16	1.92	.056	1.64	< .12	<.009	1.79	18.9
PZ- 662	4.81	26.0	2.51	.620	.143	1.91	8.6	<1.16	1.15	.047	2.12	< .08	<.007	1.93	19.2
PZ- 664	5.45	30.9	4.88	.906	.078	2.35	12.8	<1.11	1.87	.082	2.74	.18	<.007	3.22	29.3
PZ- 666	3.60	34.4	3.51	.832	.065	2.78	12.0	<1.17	.82	.052	2.64	< .18	<.007	4.87	26.3
PZ- 668	4.09	38.1	2.93	.778	.069	2.47	11.5	<1.18	.92	.066	2.31	.11	<.007	3.14	25.2
PZ- 670	5.09	37.4	2.07	.540	.198	1.98	7.3	<1.62	2.26	.106	1.58	.19	.003	1.16	17.7
PB- 671	5.39	37.9	2.32	.643	.109	2.06	8.4	<1.29	1.81	.079	1.81	.19	.004	1.04	20.9
PB- 672	3.39	21.5	1.57	.442	.193	1.36	6.0	<1.14	1.28	.026	1.33	.11	<.005	1.23	13.8
PB- 673	2.42	23.1	1.44	.368	.239	1.30	6.2	<1.14	1.49	.028	1.40	.23	<.005	1.03	13.1
PB- 674	4.51	30.4	1.64	.512	.165	1.73	7.9	.97	2.05	.073	1.80	.19	<.007	1.11	18.8
PB- 675	5.45	53.1	2.09	.615	.197	2.26	8.7	1.98	2.28	.128	1.74	.27	<.006	1.35	22.8
PB- 676	2.78	24.7	1.49	.407	.147	1.57	5.2	<1.20	2.69	.048	1.27	< .27	<.009	.78	13.4
PB- 677	3.55	46.4	1.52	.459	.174	1.95	7.0	1.57	3.27	.154	1.52	.19	.004	1.26	16.3
PB- 678	2.99	43.4	1.45	.433	.128	1.88	5.7	1.59	3.76	.208	1.36	.26	<.006	1.68	15.4
PB- 679	3.12	55.2	2.03	.571	.082	2.66	9.0	.67	3.03	.091	1.75	.06	.003	2.95	21.3
PB- 680	3.66	57.8	2.30	.636	.134	2.20	8.8	.61	2.86	.099	1.88	< .12	.009	2.14	21.3
PB- 681	3.85	24.6	1.84	.537	.062	1.70	7.5	.61	2.07	.061	1.87	.12	<.006	1.12	17.2
PB- 682	3.59	51.1	1.59	.491	.249	1.86	7.5	<1.48	3.21	.088	1.63	.10	<.006	1.51	18.8
PB- 683	4.05	45.6	2.51	.598	.151	1.47	8.6	<1.17	2.37	.093	1.60	< .17	<.006	.99	19.8
PB- 684	2.62	35.7	2.19	.637	.188	1.74	7.5	<1.53	1.59	.105	1.36	< .11	<.006	1.17	17.7
PB- 685	3.57	23.3	1.80	.549	.029	1.67	7.4	<1.37	1.48	.085	1.98	< .12	<.006	1.40	16.7
PB- 686	2.97	28.3	1.72	.483	.032	1.58	7.0	<1.11	2.89	.073	1.45	.09	<.005	1.48	15.1
PB- 687	4.94	44.6	2.04	.616	.181	1.89	7.7	<1.34	2.77	.126	2.16	.07	<.006	1.52	19.9
PB- 688	4.65	47.3	2.18	.624	.037	1.82	6.8	<1.56	1.91	.118	1.53	< .17	<.006	1.08	18.4
PB- 689	2.03	15.1	1.34	.376	.043	1.11	5.3	<1.36	1.15	.032	1.18	.08	<.005	.87	11.8
PB- 690	4.35	33.6	1.60	.475	.113	1.78	7.4	.87	1.99	.102	1.63	.06	<.006	1.06	16.2
PZ- 692	5.04	42.8	2.36	.647	.090	2.18	7.9	1.16	2.18	.134	1.84	< .14	<.008	1.70	21.1
PZ- 694	5.62	42.0	2.52	.738	.044	2.24	10.6	1.54	2.11	.108	2.23	< .20	<.007	1.98	22.9
PZ- 696	4.19	36.3	2.69	.719		2.62	10.4	1.16	1.13	.102	2.08	< .16	<.007	2.62	22.4
PZ- 698	3.86	22.5	1.69	.467	.189	1.96	6.6	<1.15	1.32	.038	1.68	.06	<.006	1.15	16.8

Table A-6b. Elemental analysis, core hole 25 (continued).

SAMPLE ID	CS	CU	DY	EU	F	FE	GA	GE	H	HG	HF	IN	IR	K	LA
ANAL.METH.	NAA PPM	XRF PPM	NAA PPM	NAA PPM	SP PERC	NAA PERC	XRF PPM	XRF PPM	COMB PERC	IZAA PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM
APPROX ERR	.15	1.5	.08	.010	.03*R	.03	.7	.68	.02	.1*R	.05	.10	.004	.20	.5
MZ- 700	3.73	21.4	1.69	.492	.131	1.45	7.4	.61	1.03	.081	3.53	.18	.003	1.55	16.3
MZ- 702	3.59	27.9	1.83	.465	.019	1.57	6.6	1.12	1.67	.044	1.42	< .17	<.006	1.10	14.8
MZ- 789	4.50	28.9	1.55	.416	.009	2.14	5.8	<1.09	.57	.048	1.24	< .15	<.006	1.12	14.2
BCS- 750	7.00	28.5	2.88	.714	.018	2.14	9.8	<1.19	2.03	.031	2.37	< .14	<.006	2.78	24.5
BCS- 790	6.19	26.0	4.18	1.106	.057	2.88	13.9	1.32	.28	.034	3.45	< .14	<.007	3.48	30.8

Table A-6c. Elemental analysis, core hole 25.

SAMPLE ID	LI	MG	MN	MO	N	NA	ND	NI	PB	RB	S(MIN)	S(ORG)	SB	SC	SE
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	COMB PERC	NAA PERC	NAA PPM	XRF PPM	XRF PPM	XRF PPM			NAA PPM	NAA PPM	XRF PPM
APPROX ERR	.015	.50	3	1.5	.01	.01	1.5	2.0	1.0	.04*R			.12	.03	.30
SCZ- 180	.229	2.60	414	4.9	.14	3.29	27.6	32.0	20.7	87.3			.72	9.47	.76
SCZ -230	.161	3.19	443	13.1	.27	1.91	19.5	22.2	16.5	86.4			1.37	7.46	1.16
SCZ- 280	.219	3.35	460	8.8	.30	1.87	21.4	22.2	14.3	69.8			1.09	6.93	1.29
SCZ- 330	.197	4.24	441	9.5	.24	1.89	19.0	19.9	18.4	69.7			1.14	7.11	1.27
SCZ- 380	.211	3.53	407	11.9	.32	1.57	19.1	18.5	16.8	75.1			1.41	6.78	1.69
CCS- 393	.217	4.37	398	17.2	.42	1.46	17.8	22.8	19.7	79.1			1.77	6.54	1.72
CCS- 398	.190	3.60	400	15.7	.50	1.35	17.5	21.5	22.9	85.8			2.02	6.97	2.24
CCS- 403	.165	3.34	436	8.0	.47	1.03	19.1	20.5	17.2	82.9			1.67	7.06	2.26
CCS- 408	.142	2.79	412	22.2	.39	1.45	15.4	20.8	33.2	67.6			1.89	5.68	2.17
CCS- 413	.159	3.39	406	12.2	.34	1.60	14.6	19.3	22.0	64.9			1.64	5.69	2.34
CCS- 418	.122	3.72	421	13.5	.31	1.00	11.0	16.7	9.1	47.6			.93	3.74	1.51
CCS- 423	.130	3.32	417	12.5	.30	1.23	11.6	17.5	13.1	52.5			.97	4.16	1.33
CCS- 428	.168	3.26	410	16.6	.43	1.41	13.8	24.0	22.7	77.8			1.42	6.42	1.09
CCS- 433	.129	4.11	403	13.9	.34	1.54	14.2	17.3	15.2	60.3			.93	5.14	1.20
CCS- 438	.170	3.96	416	15.4	.48	1.53	15.2	21.5	21.0	63.2			1.11	5.56	1.33
CCS- 443	.141	3.44	391	20.6	.69	1.21	14.6	18.7	23.7	65.3			1.21	5.90	1.50
CCS- 448	.186	4.10	430	15.4	.52	1.49	18.8	24.3	26.3	79.6			1.32	7.05	1.15
CCS- 453	.150	3.54	391	17.0	.38	1.91	15.0	22.4	26.4	73.9			1.51	6.79	1.02
CCS- 458	.170	3.36	379	17.0	.44	1.82	20.1	22.9	24.2	71.5			1.37	6.63	1.18
CCS- 463	.173	3.58	399	16.2	.27	1.70	17.7	17.3	19.5	67.2			1.15	6.36	.49
CCS- 468	.175	3.89	383	8.1	.35	1.56	17.6	24.6	20.9	94.5			1.58	8.29	.89
CCS- 473	.191	4.04	332	18.1	.42	1.82	16.4	23.0	23.5	73.0			1.74	6.86	1.41
CCS- 478	.200	3.82	369	7.8	.32	1.88	21.2	18.3	20.3	82.6			1.51	7.59	1.03
CCS- 483	.164	3.43	326	13.8	.36	1.67	16.9	18.5	18.1	66.9			1.50	6.06	1.28
CCS- 488	.174	4.95	315	15.2	.39	1.43	13.1	21.3	18.2	70.6			1.39	6.24	1.22
CCS- 493	.193	4.16	384	11.0	.56	1.09	18.5	23.8	24.1	102.0			1.98	8.08	1.31
CCS- 498	.189	2.75	274	24.7	.55	1.34	17.8	20.5	21.5	61.1			1.45	5.74	1.32
CCS- 503	.155	4.36	368	6.8	.46	.89	16.1	20.3	17.5	89.7			1.13	6.56	1.11
CCS- 508	.175	3.87	355	10.8	.34	1.70	20.6	20.1	18.7	65.5			1.36	5.79	1.46
CCS- 513	.156	3.43	298	20.6	.45	2.01	13.1	20.2	18.9	61.4			1.78	5.77	1.54
CCS- 518	.153	3.48	333	20.9	.43	.86	17.1	19.8	24.0	84.2			1.62	6.30	1.58
CCS- 523	.188	3.83	328	25.9	.70	1.23	14.3	19.6	26.1	80.8			2.11	6.14	2.17
CCS- 528	.190	3.39	355	21.8	.54	.80	16.5	19.0	22.5	82.6			1.49	6.22	1.04
CCS- 533	.177	4.07	392	15.5	.52	.48	19.9	23.5	20.8	93.6			1.59	6.72	1.76
CCS- 538	.174	2.96	340	15.7	.35	1.97	22.6	22.2	19.0	70.4			1.65	5.48	1.62
CCS- 543	.121	3.80	388	8.7	.28	1.31	16.9	14.0	10.9	57.2			.76	4.33	1.26
CCS- 548	.147	4.43	375	11.2	.26	1.39	12.0	14.8	12.6	60.7			.78	4.62	1.47
CCS- 553	.125	3.27	373	13.6	.27	1.45	18.9	17.4	13.4	60.1			1.11	4.78	1.54
CCS- 558	.136	3.97	335	9.8	.28	1.38	14.7	14.1	13.8	62.7			1.08	4.70	1.06
CCS- 563	.158	4.20	365	14.5	.32	1.15	16.5	14.8	14.4	80.0			1.26	5.73	.68
CCS- 568	.128	3.98	281	13.0	.37	1.01	13.8	14.6	13.8	64.9			1.39	4.40	1.29
CCS- 573	.116	3.84	381	10.2	.29	1.15	11.8	16.7	13.6	61.6			1.25	4.30	1.02
CCS- 578	.123	1.90	349	7.4	.19	2.43	18.1	18.6	16.5	48.1			.97	3.55	1.45
CCS- 583	.130	3.25	313	10.4	.26	1.36	14.2	14.5	10.7	53.8			1.85	4.06	1.07
CCS- 588	.133	3.16	300	12.6	.38	1.05	12.1	19.1	12.4	56.9			1.68	4.23	1.69
CCS- 593	.132	3.95	325	12.9	.33	1.66	14.9	18.6	14.6	58.3			1.41	5.81	1.83
CCS- 598	.147	4.00	350	9.6	.29	1.47	15.2	20.5	12.9	62.7			1.38	5.97	1.06
CCS- 603	.154	4.61	373	10.3	.41	.60	18.4	17.3	13.7	88.8			1.45	6.18	1.18

Table A-6c. Elemental analysis, core hole 25 (continued).

SAMPLE ID	LI	MG	MN	MO	N	NA	ND	NI	PB	RB	S(MIN)	S(ORG)	SB	SC	SE
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	COMB PERC	NAA PERC	NAA PPM	XRF PPM	XRF PPM	XRF PPM			NAA PPM	NAA PPM	XRF PPM
APPROX ERR	.015	.50	3	1.5	.01	.01	1.5	2.0	1.0	.04*R			.12	.03	.30
CCS- 608	.160	4.69	329	12.5	.38	1.36	15.5	21.0	11.3	60.3			1.10	4.68	1.04
CCS- 613	.129	3.63	276	26.7	.56	1.16	15.6	21.2	16.4	63.1			1.16	5.07	1.58
CCS- 614	.181	3.23	326	11.4	.96	.91	17.4	18.3	15.2	75.7			1.48	6.53	1.73
CCS- 623	.172	3.70	308	20.5	.53	1.10	18.6	21.2	20.4	71.7			1.88	6.21	2.01
CCS- 628	.167	3.63	343	12.1	.28	1.32	18.4	19.2	14.1	61.0			1.28	5.70	1.89
CCS- 634	.192	5.91	361	8.4	.33	1.10	19.5	18.2	15.4	60.7			.78	7.63	.73
PZ- 636	.249	4.11	387	6.6	.37	.40	24.1	26.7	21.2	115.0			1.46	10.28	1.07
PZ- 639	.254	2.73	398	12.0	.47	.53	25.0	22.1	24.3	127.0			2.00	7.60	1.37
PZ- 640	.226	2.48	391	11.9	.41	.56	24.6	27.5	27.5	132.0			1.99	7.88	1.19
PZ- 642	.190	3.76	345	21.2	.48	.81	22.1	23.3	28.6	132.0			1.68	7.01	1.64
PZ- 644	.196	4.52	358	11.8	.52	.65	20.5	19.8	17.3	139.0			1.21	8.03	1.00
PZ- 646	.172	4.37	267	30.4	.63	1.63	18.8	19.7	24.7	53.3			1.51	5.21	1.43
PZ- 648	.167	5.21	292	24.1	.50	1.37	15.6	20.8	17.1	75.7			1.16	5.63	1.04
PZ- 650	.153	3.97	289	37.6	.36	3.06	20.2	23.4	25.5	58.0			1.55	5.19	2.09
PZ- 652	.182	2.82	292	28.4	.44	1.94	19.4	21.2	23.1	58.0			1.77	6.37	2.14
PZ- 654	.155	2.72	285	33.6	.53	2.86	14.7	26.1	30.0	72.2			2.45	6.50	2.09
PZ- 656	.201	2.28	324	16.4	.52	1.92	17.7	20.0	13.7	63.2			1.38	6.65	.75
PZ- 658	.189	2.87	389	11.3	.49	1.81	19.1	21.3	17.0	75.5			1.77	6.87	1.27
PZ- 660	.215	3.26	354	11.9	.50	1.45	15.3	21.7	13.3	68.1			1.50	6.23	.95
PZ- 662	.241	3.12	369	8.0	.49	1.25	16.8	21.5	14.7	80.0			1.55	6.67	1.03
PZ- 664	.364	2.33	383	8.2	.57	1.46	27.7	21.2	18.3	98.9			1.98	7.33	1.13
PZ- 666	.368	3.05	407	9.9	.61	.43	23.8	24.0	22.2	107.0			1.99	8.54	1.30
PZ- 668	.242	3.26	373	17.3	.58	.83	19.9	19.4	21.6	95.3			1.57	8.30	1.87
PZ- 670	.230	4.30	255	41.9	.72	1.58	15.6	26.4	25.3	68.1			1.99	5.78	2.24
PE- 671	.165	3.69	348	21.7	.41	2.14	17.8	21.8	22.4	58.9			2.13	6.42	1.22
PE- 672	.133	5.04	311	24.8	.33	1.35	10.8	17.4	7.6	62.2			1.07	4.54	1.03
PE- 673	.111	5.63	271	17.5	.41	1.24	11.3	16.4	13.9	66.4			1.29	3.97	1.10
PE- 674	.136	4.26	268	27.9	.59	1.80	13.1	20.9	26.2	65.2			2.45	5.19	1.82
PE- 675	.136	3.35	303	43.0	.57	2.16	17.4	28.0	35.6	61.7			3.88	6.05	2.98
PE- 676	.124	3.46	228	29.8	.66	1.50	11.5	17.3	17.4	49.5			1.08	4.41	1.20
PE- 677	.173	3.01	210	38.9	.85	1.84	11.9	29.8	32.4	66.4			1.57	5.32	2.22
PE- 678	.117	2.37	201	39.8	1.06	1.53	9.3	25.2	30.8	60.7			2.76	4.69	2.24
PE- 679	.187	2.84	261	41.0	1.03	1.37	13.8	30.0	37.5	82.4			3.27	6.17	1.59
PE- 680	.222	2.28	294	32.4	.99	1.67	16.5	25.6	38.4	72.8			2.94	6.59	2.51
PE- 681	.130	3.63	315	24.3	.62	1.75	15.5	23.0	15.5	53.0			1.57	5.59	1.38
PE- 682	.164	3.68	246	47.6	1.01	1.86	14.4	27.5	39.0	90.9			3.23	5.83	2.70
PE- 683	.204	1.90	283	26.5	.69	1.99	16.9	23.4	29.1	59.1			3.20	5.08	2.62
PE- 684	.174	2.19	268	13.9	.52	1.74	14.9	22.1	17.8	60.4			2.20	5.26	2.46
PE- 685	.121	3.64	313	21.1	.44	1.61	13.1	22.5	15.2	61.8			1.88	5.18	1.71
PE- 686	.155	3.79	279	25.2	.61	1.42	14.3	19.4	18.3	60.1			2.11	4.71	2.84
PE- 687	.129	2.70	317	27.0	.81	1.69	18.0	24.9	30.0	76.2			2.41	5.15	3.74
PE- 688	.130	2.50	313	26.9	.61	1.91	15.5	23.4	29.1	60.0			3.22	5.27	3.30
PE- 689	.144	3.27	338	7.0	.43	1.30	9.1	15.7	7.2	46.9			1.24	3.69	1.11
PE- 690	.156	3.07	271	21.3	.61	1.67	15.2	22.5	19.9	58.1			2.26	5.10	2.64
PZ- 692	.155	3.18	319	24.7	.62	1.83	18.6	24.9	26.5	65.5			2.80	5.99	2.93
PZ- 694	.163	3.44	325	21.5	.68	1.84	21.2	28.5	27.8	78.6			2.69	6.49	2.34
PZ- 696	.182	3.60	303	14.4	.41	1.67	19.2	25.1	24.3	80.5			2.07	7.42	1.39
PZ- 698	.135	4.80	292	14.8	.40	1.54	14.4	19.6	13.8	70.8			1.32	5.01	.49

Table A-6c. Elemental analysis, core hole 25 (continued).

SAMPLE ID	LU	MG	MN	MO	N	NA	ND	NI	PB	RB	S(MIN)	S(ORG)	SB	SC	SE
ANAL.METH.	NAA PPM	NAA PERC	NAA PPM	NAA PPM	COMB PERC	NAA PERC	NAA PPM	XRF PPM	XRF PPM	XRF PPM			NAA PPM	NAA PPM	XRF PPM
APPROX ERR	.015	.50	3	1.5	.01	.01	1.9	2.0	1.0	.04*R			.12	.03	.30
MZ- 700	.141	3.45	272	15.1	.39	1.47	14.6	17.9	12.6	62.2			1.24	4.70	.76
MZ- 702	.152	5.01	252	21.1	.51	1.39	15.2	16.8	13.8	69.9			1.32	5.05	1.11
MZ- 705	.133	3.43	245	23.5	.25	1.25	14.7	18.2	18.1	58.8			.86	7.18	1.59
FCS- 750	.224	4.63	332	10.1	.56	1.26	23.4	20.1	13.1	102.0			.86	7.20	
FCS- 790	.400	2.00	416	1.6		2.48	32.1	23.3	14.3	98.5			1.12	10.33	.33

Table A-6d. Elemental analysis, core hole 25.

SAMPLE ID	SB	SN	SR	TA	TB	TH	TI	U	V	W	Y	YB	ZN	ZR
ANAL.METH.	NAA PPM	NAA PPM	XRF PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM	NAA PPM	XRF PPM	NAA PPM	XRF PPM	XRF PPM
APPROX ERR	.01	50	.04*R	.004	.020	.05	.020	.03	15	.30	.6	.03	.04*R	2.0
SCZ- 180	4.20	132	662.	.680	.434	10.28	.306	3.49	113	.75	17.1	1.64	81.3	123.
SCZ -230	3.34	< 123	650.	.576	.402	6.93	.155	2.81	91	1.17	13.4	1.34	78.6	52.2
SCZ- 280	3.24	46	688.	.550	.403	7.07	.129	3.34	78	1.26	13.9	1.48	66.3	45.1
SCZ- 333	3.10	58	647.	.516	.366	7.27	.146	2.90	94	.90	13.3	1.41	64.6	45.8
SCZ- 388	3.09	76	671.	.510	.383	7.23	.174	3.25	94	1.38	13.7	1.39	69.0	56.1
CCS- 393	3.13	59	744.	.484	.365	7.02	.157	5.39	83	1.56	12.5	1.45	67.6	53.8
CCS- 398	2.89	65	719.	.448	.339	7.31	.126	4.22	97	1.69	13.0	1.44	75.4	51.7
CCS- 403	3.13	64	678.	.476	.396	5.32	.156	2.19	87	1.26	11.1	1.21	78.7	43.2
CCS- 408	2.45	< 125	836.	.396	.301	4.81	.142	2.78	87	1.25	9.7	.99	70.6	41.9
CCS- 413	2.44	58	423.	.373	.315	4.60	.087	1.95	86	1.24	9.4	.95	68.6	42.3
CCS- 418	1.61	43	1050.	.270	.231	4.54	.077	2.81	45	.89	7.3	.83	44.7	35.3
CCS- 423	1.59	51	1000.	.317	.227	3.96	.117	2.60	48	1.37	8.5	.87	52.3	40.2
CCS- 428	2.44	65	686.	.449	.293	5.09	.167	2.86	74	1.34	9.0	1.12	70.8	50.1
CCS- 433	2.08	< 112	786.	.379	.248	4.29	.095	2.91	88	1.40	7.7	.88	55.6	46.9
CCS- 438	2.66	42	752.	.399	.308	5.53	.102	3.72	102	1.18	9.8	1.11	56.7	44.2
CCS- 443	2.47	60	643.	.409	.285	5.26	.128	4.15	120	1.40	9.0	1.12	61.1	33.7
CCS- 448	2.88	61	611.	.489	.342	6.26	.169	3.64	93	1.04	11.0	1.29	72.4	50.1
CCS- 453	2.95	53	679.	.477	.343	5.88	.162	3.42	90	1.37	12.0	1.29	70.7	49.4
CCS- 458	2.57	101	592.	.457	.293	5.67	.153	3.77	93	1.64	9.7	1.15	65.3	42.1
CCS- 463	2.57	119	638.	.451	.307	6.22	.124	3.59	105	1.43	9.6	1.15	59.4	41.4
CCS- 468	3.17	68	513.	.535	.423	6.09	.185	2.88	80	1.03	11.8	1.36	78.0	55.3
CCS- 473	2.81	58	600.	.468	.334	6.93	.115	4.76	80	2.13	11.3	1.32	79.0	36.5
CCS- 478	3.16	< 120	611.	.493	.411	6.21	.165	3.10	104	.23	12.0	1.28	82.5	40.4
CCS- 483	2.83	42	715.	.442	.368	7.15	.151	4.45	81	1.34	11.4	1.30	72.8	37.6
CCS- 488	2.69	< 113	733.	.428	.332	6.30	.114	4.30	73	.95	10.5	1.34	67.1	52.5
CCS- 493	3.64	88	532.	.573	.492	7.26	.192	3.11	94	1.39	15.0	1.51	94.4	57.4
CCS- 498	2.88	60	810.	.545	.423	9.16	.085	5.47	68	1.19	12.5	1.49	66.1	36.5
CCS- 503	3.02	69	679.	.482	.344	4.86	.178	1.96	78	.59	11.8	1.16	71.1	53.7
CCS- 508	2.90	65	780.	.486	.341	7.50	.145	4.77	84	.99	11.7	1.33	60.6	54.4
CCS- 513	2.82	70	672.	.479	.374	6.63	.139	4.46	91	.77	10.9	1.21	63.1	64.2
CCS- 518	2.89	< 121	718.	.461	.355	6.60	.138	4.53	100	1.35	12.3	1.27	65.3	63.5
CCS- 523	2.70	< 115	550.	.513	.316	6.48	.148	5.07	100	.55	10.6	1.35	69.3	53.0
CCS- 528	3.11	42	612.	.537	.399	7.99	.123	4.34	83	.99	14.7	1.65	67.7	56.6
CCS- 533	3.25	53	564.	.535	.404	5.65	.124	2.86	88	1.15	12.9	1.33	79.0	61.0
CCS- 538	3.01	< 118	556.	.610	.361	7.86	.102	3.52	64	.83	12.8	1.38	67.7	67.3
CCS- 543	2.09	< 79	840.	.367	.267	5.06	.077	2.29	62	.83	8.0	.91	50.2	54.8
CCS- 548	2.44	62	829.	.386	.313	5.53	.084	2.45	59	1.21	10.6	1.00	55.1	47.5
CCS- 553	2.44	83	834.	.390	.317	6.28	.071	3.74	70	1.34	10.9	1.09	54.8	50.0
CCS- 558	2.33	< 105	894.	.377	.292	5.14	.056	3.10	73	.73	8.6	.96	52.3	47.4
CCS- 563	2.86	< 116	760.	.439	.349	6.38	.126	2.77	72	.75	12.1	1.28	60.3	48.3
CCS- 568	2.19	46	927.	.344	.304	6.11	.123	4.02	74	.92	9.7	1.09	54.2	40.0
CCS- 573	2.22	< 108	912.	.478	.269	5.58	.131	2.38	47	.59	8.8	.93	47.3	39.6
CCS- 578	2.75	< 100	695.	.722	.319	8.73	.099	3.02	50	.83	11.3	1.09	44.8	57.8
CCS- 583	2.23	65	1000.	.392	.282	6.34	.114	3.11	67	.75	10.0	1.01	42.3	35.9
CCS- 588	2.02	< 88	1020.	.386	.253	4.40	.087	3.33	93	1.00	9.0	.89	49.9	43.2
CCS- 593	2.68	< 129	833.	.383	.362	6.12	.147	3.63	82	.24	11.3	1.25	65.1	49.9
CCS- 598	2.52	< 107	936.	.381	.340	5.41	.134	3.25	70	.90	11.6	1.16	62.3	53.9
CCS- 603	2.78	< 127	710.	.440	.320	6.16	.161	2.60	93	.91	11.6	1.10	72.5	52.0

Table A-6d. Elemental analysis, core hole 25 (continued).

SAMPLE ID	SB	SN	SR	TA	TB	TH	TI	U	V	W	Y	YB	ZN	ZR
ANAL.METH.	NAA PPM	NAA PPM	XRF PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM	NAA PPM	XRF PPM	NAA PPM	XRF PPM	XRF PPM
APPROX ERR	.01	50	.04*R	.004	.020	.05	.020	.03	15	.30	.6	.03	.04*R	2.0
CCS- 604	2.38	< 102	977.	.364	.304	5.18	.101	3.66	68	1.23	10.1	1.04	58.1	43.0
CCS- 613	2.45	71	922.	.392	.316	5.63	.146	6.12	74	.84	9.3	1.16	60.9	37.5
CCS- 618	3.00	55	780.	.420	.369	7.19	.148	3.61	75	.40	12.9	1.29	68.1	43.6
CCS- 623	2.53	44	777.	.419	.381	6.10	.153	4.05	78	1.17	11.5	1.24	70.7	43.0
CCS- 628	2.75	105	851.	.403	.351	6.39	.166	3.10	78	1.30	11.7	1.14	63.4	50.7
CCS- 634	3.03	68	765.	.474	.370	7.34	.157	3.05	98	1.05	14.5	1.42	60.3	61.7
PZ- 636	3.74	63	502.	.624	.466	6.01	.222	2.99	143	1.46	17.1	1.75	51.1	81.0
PZ- 638	4.47	57	356.	.754	.575	6.91	.268	3.27	119	.84	20.6	1.74	94.4	81.0
PZ- 640	4.06	71	327.	.754	.556	6.19	.270	3.05	109	1.24	19.7	1.71	111.0	85.8
PZ- 642	3.10	97	479.	.656	.385	5.12	.207	2.87	122	1.19	12.4	1.35	100.0	68.8
MZ- 644	3.19	< 131	552.	.569	.400	5.38	.214	3.00	134	1.09	14.5	1.49	88.7	63.4
PZ- 646	2.82	59	797.	.459	.334	9.21	.099	6.00	87	.56	10.3	1.27	66.7	33.7
MZ- 648	2.95	44	865.	.506	.327	6.64	.181	3.08	88	1.34	11.8	1.09	68.8	37.1
PZ- 650	3.39	54	595.	.770	.327	9.34	.169	4.82	82	.85	11.0	1.18	67.4	49.6
PZ- 652	3.05	56	760.	.454	.344	6.44	.150	4.75	100	.96	10.9	1.29	70.6	54.8
MZ- 654	2.96	75	539.	.483	.358	5.35	.139	5.07	114	1.57	9.6	1.18	84.9	48.9
PZ- 656	3.23	79	713.	.489	.388	7.98	.174	5.07	114	.82	12.6	1.52	66.7	59.7
MZ- 658	3.30	< 112	710.	.482	.394	6.61	.172	3.02	79	.70	13.5	1.39	81.2	49.9
PZ- 660	2.94	71	827.	.414	.384	6.78	.104	4.01	97	1.47	13.9	1.53	67.8	45.3
PZ- 662	3.03	73	716.	.449	.369	7.73	.177	4.72	89	1.13	12.8	1.65	70.5	53.6
MZ- 664	5.31	90	464.	.763	.727	7.93	.207	4.11	89	1.53	28.3	2.61	82.5	61.1
PZ- 666	4.12	< 138	459.	.619	.534	7.36	.235	4.12	116	.99	20.3	2.00	90.7	77.4
MZ- 668	3.74	83	620.	.534	.532	7.93	.175	3.69	115	1.36	17.0	1.69	80.8	66.3
PZ- 670	2.68	< 108	687.	.392	.335	5.58	.112	5.92	128	1.22	9.9	1.34	71.3	41.2
PB- 671	2.94	84	676.	.418	.401	5.94	.149	3.47	111	.86	12.2	1.23	70.0	50.5
PB- 672	2.12	< 82	868.	.307	.247	4.90	.105	3.55	71	1.04	7.8	.90	51.9	44.6
MB- 673	1.77	50	786.	.284	.222	4.00	.088	3.38	82	1.09	5.7	.75	53.1	48.6
MB- 674	2.28	44	606.	.415	.243	4.75	.119	3.75	109	1.98	6.6	.88	66.9	49.7
PB- 675	2.55	79	495.	.435	.373	5.92	.139	4.96	135	1.03	8.7	1.18	81.6	43.3
PB- 676	1.91	54	616.	.296	.224	4.13	.103	5.04	98	1.22	4.7	.79	60.8	23.1
MB- 677	2.17	49	374.	.353	.254	4.50	.133	4.73	168	.99	5.0	.92	74.1	23.6
PB- 678	2.04	49	384.	.330	.234	4.49	.116	4.71	129	1.46	3.8	.91	74.0	18.3
MB- 679	2.77	103	300.	.464	.285	5.46	.172	4.29	185	1.56	8.1	1.22	87.0	35.4
PB- 680	3.02	125	421.	.467	.351	6.30	.145	4.46	151	1.18	10.0	1.39	85.7	39.6
PB- 681	2.57	< 80	568.	.405	.291	4.88	.149	3.90	116	1.93	8.3	1.08	62.0	41.2
MB- 682	2.34	88	378.	.389	.276	3.79	.126	2.68	157	1.94	4.7	.90	88.7	31.8
PB- 683	3.12	< 120	668.	.396	.371	6.19	.161	5.16	105	1.15	12.5	1.51	73.8	32.9
PB- 684	2.75	105	861.	.350	.326	6.28	.139	3.76	104	1.12	11.1	1.26	65.4	41.3
PB- 685	2.45	40	793.	.393	.288	3.88	.122	2.72	94	2.98	8.8	.97	56.5	60.9
PB- 686	2.28	65	794.	.349	.266	4.61	.167	3.89	101	1.31	8.5	1.00	60.3	39.7
PB- 687	2.91	65	448.	.414	.302	4.50	.121	3.58	97	1.16	7.3	1.03	76.5	60.6
PB- 688	2.92	46	721.	.394	.351	5.20	.119	2.79	116	1.60	9.5	1.11	71.4	41.0
MB- 689	1.74	54	1120.	.266	.200	3.77	.094	2.69	72	1.62	7.1	.85	41.3	35.4
PB- 690	2.26	52	759.	.379	.264	4.47	.124	4.10	111	1.86	7.0	.95	62.1	40.4
PZ- 692	3.02	61	603.	.452	.322	6.82	.144	5.96	141	2.45	10.9	1.41	75.8	47.4
PZ- 694	3.34	< 128	418.	.548	.425	6.48	.148	4.80	129	2.05	11.8	1.44	81.9	59.2
PZ- 696	3.44	< 132	660.	.505	.436	6.51	.126	3.82	128	2.03	13.9	1.44	78.8	62.8
PZ- 698	2.32	83	849.	.358	.267	4.97	.128	3.81	96	.58	8.9	1.00	54.1	33.9

Table A-3d. Elemental analysis, core hole 25 (continued).

Table A-6d.

SAMPLE ID	S		SR	TA	TB	TH	TI	U	V	W	Y	YB	ZN	ZR
ANAL.METH.	NAA PPM	PPM	XRF PPM	NAA PPM	NAA PPM	NAA PPM	NAA PERC	NAA PPM	NAA PPM	NAA PPM	XRF PPM	NAA PPM	XRF PPM	XRF PPM
APPROX ERR	.01	50	.34*R	.004	.020	.05	.020	.03	15	.30	.6	.03	.04*R	2.0
MZ- 700	2.30	59	816.	.364	.294	4.22	.097	3.71	72	.95	8.6	.99	54.9	219.0
MZ- 702	2.25	81	786.	.405	.279	5.99	.091	5.82	74	1.14	7.9	1.08	60.3	33.1
MZ- 705	1.58	47	820.	.311	.446	7.70	.094	3.83	75	1.06	6.1	.85	63.5	24.6
FCS- 753	3.63	47	733.	.565	.447	7.72	.204	4.21	98	1.31	17.1	1.62	75.1	78.8
FCS- 790	5.25	99	369.	.843	.679	10.47	.263	5.29	140	.86	25.6	2.49	94.6	118.0